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ABSTRACT

The two research reports included in this document describe the application of the Health Services Mobility Study (HSMS) task analysis method to two technologist functions and examine the interrelationships of these tasks with those in diagnostic radiology. (The HSMS method includes processes for using the data for designing job ladders, for developing curriculum objectives, and for constructing evaluation instruments and proficiency tests.) The first report (no. 9) presents eighty-six new task descriptions at the aide, technician, and technologist level in two developing occupational specialties, radiation therapy and diagnostic ultrasound. The report describes how the tasks were developed and how to read them. Also included are listings that arrange the tasks by function and an index of tasks by code number. The second report (no. 10), covering the tasks in report no. 9 and a previous HSMS report which relates technologist tasks in diagnostic radiology (no. 7), indicates what skill and knowledge data and task analysis show about the interrelationships of the tasks in diagnostic radiology, ultrasound technology, and radiation therapy. The report also describes the skill and knowledge overlaps across specialties and the relative job levels to which the tasks can be assigned. (The four volumes of research report no. 7 are available as ERIC documents ED 129 977, ED 130 077-078, and ED 130 131-132. (BM)

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THE TECHNOLOGIST FUNCTION IN FIELDS RELATED TO RADIOLOGY: TASKS IN RADIATION THERAPY AND DIAGNOSTIC ULTRASOUND

Research Report No. 9

RELATING TECHNOLOGIST TASKS IN DIAGNOSTIC RADIOLOGY, ULTRASOUND AND RADIATION THERAPY

Research Report No. 10

by

Eleanor Gilpatrick, Director
Health Services Mobility Study

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Eleanor Gilpatrick

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PREFACE

The Health Services Mobility Study (HSMS) has been involved in research in the health manpower field in the United States since 1967. It has designed methods to analyze jobs, create job ladders, develop curriculum objectives, and evaluate job performance. HSMS is sponsored by the City University of New York (CUNY) through the Research Foundation and the Hunter College School of Health Sciences. Since its inception, funding for HSMS has come from the Office of Economic Opportunity, the Health Services and Mental Health Administration and the Bureau of Health Manpower, both of HEW, and, primarily, the U.S. Department of Labor, Manpower Administration, now the Employment and Training Administration. The Director of the Project, Eleanor Gilpatrick, holds the rank of Associate Professor at the Hunter College School of Health Sciences, City University of New York.

The two reports contained in this document, Research Reports 9 and 10, describe the application of the HSMS task analysis method to two technologist functions and examine the interrelationships of these tasks with those in diagnostic radiology. This work is reported as follows:

Research Rpt. No. 9	THE TECHNOLOGIST FUNCTION IN FIELDS RELATED TO RADIOLOGY: TASKS IN RADIATION THERAPY AND DIAGNOSTIC ULTRASOUND. This report presents tasks at the aide, technician, and technologist level in two fields related to diagnostic radiology. It is a scaled-down application of the HSMS task description method to two developing occupational specialties. The document describes how the tasks were developed and how to read them. It also includes listings that arrange the tasks by function and an index of tasks by code number. It covers 86 new task descriptions.
Research Rpt. No.10	RELATING TECHNOLOGIST TASKS IN DIAGNOSTIC RADIOLOGY, ULTRASOUND AND RADIATION THERAPY. This report covers the tasks of Research Reports 7 and 9. It indicates what skill and knowledge data and task analysis show about the interrelationships of tasks in these three technologist specialties related to radiology. It reports on the skill and knowledge overlaps across the specialties and the relative job levels to which the tasks can be assigned.

Research Rpt. No. 7	TASK DESCRIPTIONS IN DIAGNOSTIC RADIOLOGY.
Vol. 2	Radiologic Technologist Tasks Dealing With Patient Procedures.
Vol. 3	Machine-Related, Patient Care and Administrative Tasks: What Radiologists, Technologists, Nurses, and Physicists Do To Run Things and Look After Patients and Equipment.

Volumes 2 and 3 of this report present detailed task descriptions at the aide, technician, technologist, supervisory and radiation physicist level in diagnostic radiology. Some tasks overlap with those of Research Report No. 9. The tasks of these two volumes are included in the analysis reported in Research Report No. 10. (Volume 1 reports radiologist tasks, and Volume 4 is an index of tasks.)

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CHAPTER 1

ABOUT THE HSMS TASK DESCRIPTIONS AND SUMMARIES

INTRODUCTION

The Health Services Mobility Study (HSMS) has produced a method of task analysis involving task identification, task description, the rating of tasks for skill and knowledge requirements,and the grouping of tasks into related hierarchies. The method includes processes for using the data for the design of job ladders, for developing curriculum objectives, and as inputs to the construction of evaluation instruments and proficiency tests. A full-scale application of the method was carried out in the area of diagnostic radiology. That effort required about four years of work and resulted in a voluminous series of reports.[1]

Many people who have been following the work of HSMS have asked for a scaled-down version of the method. While a user of the HSMS method may have need for enough information to be able to rate tasks for the skills and knowledges they require, to be able to determine basic curriculum objectives, and/or to identify basic inputs for evaluation or test instruments, there are few institutions with the time, staff, and money to carry out all the steps of the method as conducted by the HSMS in its work in diagnostic radiology. An added incentive for HSMS to find a briefer version of the method was the fact that HSMS comes to the end of its existence as a government funded R and D project in late 1977. Without sufficient time, funds, and staff to do task analysis in radiotherapy, ultrasound and nuclear medicine in the detail that was originally planned, we needed to find a short-cut.

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[1] Eleanor Gilpatrick, Task Descriptions in Diagnostic Radiology, Research Report No. 7 (Volumes 1, 2, 3 and 4), New York: Health Services Mobility Study, 1976; and Eleanor Gilpatrick, Using Task Data in Diagnostic Radiology, Research Report No. 8 (Volumes 1 and 2), New York: Health Services Mobility Study, 1977.

Research Report No. 9 presents the application of the Health Services Mobility Study task analysis method in a modified, shorter form. The Report's scope is reduced to only the technologist level, and to two of the three fields related to radiology. Chapters 1, 2 and 3 are addressed to radiation therapy technology. Chapters 4 and 5 deal with ultrasound as a diagnostic technology. (Chapter 6 is an index of the tasks in this report.) The report does not cover nuclear medicine as originally planned.

The full-scale application of the HSMS task analysis method produces detailed task descriptions for each work activity carried out in a specified area of interest. Regardless of the similarity of tasks, each task identified is completely described and is totally self-contained. No reference is made to other tasks. A complex task description can run for many pages.

When many tasks in a given functional area are quite similar, there is a good deal of repetition across tasks. Many HSMS full-scale task descriptions are exactly the same except for a few significant sections. For example, radiographic examinations can be described with the same language except for reference to the parts of the body involved, the positioning, specific nursing steps, and other similar details. Once we saw that the language uniformities across tasks could be consolidated for the preparation of behavioral objectives for curriculum design or for use as inputs for test construction, we concluded that this could become the basis of a shorter method of task description. We decided to have full-scale task description models and briefer task summaries.

This report contains a limited number of full-scale task descriptions. Each of these detailed task descriptions represents our best efforts to describe all the steps of a task in appropriate sequence, covering its range of options and contingencies, and including desirable procedures (even if not commonly found in current practice) which help ensure accuracy, safety, and concern for the patient. In the HSMS brief method, presented here, these task descriptions are used as models. When a series of tasks are similar in their basic steps, we present one or two models and use summaries for the remaining tasks that refer back to the models.

Many of the tasks in this report are in the form of task summaries. The tasks are identified in terms of their outputs, things used, and personnel involved, and are described by a summary of the important elements of the task. When detailed task description models have been developed and are applicable to groups of similar tasks, the summary refers the reader to the details in the models; it provides details only in those areas that are unique to the particular task involved. The task summaries limit detail without sacrificing basic information. They can be scaled for skill and knowledge requirements using HSMS skill and knowledge categories and scales.

This report also contains tasks represented only by their extended task names. These provide brief summaries of the main features and main elements of the tasks without further detail. We present a task this way if it can be scaled for skills and knowledge from a reading of its extended task name. The chief use for this level of abstraction is where curriculum construction or test design is not the main focus, but where task inventories with more detail than in the usual brief task listing are desired, such as in the design of career ladders, assignment of tasks to titles, preparation of job descriptions, or identification of overlap tasks. If we go on to skill and knowledge scaling,we utilize background literature as a resource, but save the time needed to prepare more detailed task summaries or descriptions.

We found some tasks in radiotherapy and ultrasound technology that are also carried out in diagnostic radiology. Since Research Report No. 7 carries detailed task descriptions for all diagnostic tasks covered, we present only extended task names in this volume for such "overlap tasks," and refer the reader to Research Report No. 7 for the detailed task descriptions. These cases of overlap tasks demonstrate the "economy of scale" provided by the HSMS definition of task when the method is applied to several areas. Because the HSMS method identifies tasks regardless of job title or institution, the detailed task descriptions need be done only once; they are then applicable for use in any other context, such as another institution, occupation, or industry.

CHAPTERS 1, 2 and 3: RADIATION THERAPY TECHNOLOGY

Chapter 1 of this report describes the concepts, methods and coverage represented by the task identifications and descriptions in Chapter 3. Chapter 2 provides a listing of tasks by function. Each listing presents the task by its abbreviated name and code number. Chapter 3 presents the tasks in numerical order by code number, regardless of whether a task is presented as a detailed task description, as a task summary, or as an extended task name. Where a task is presented as an extended task name and the detailed description appears in Research Report No. 7, this is so indicated. (Pagination for Chapter 3 appears at the top of each page.)

COLLECTION AND COVERAGE

Chapters 1, 2 and 3 contain task descriptions, task summaries, extended task names and abbreviated task names which cover most of the work of the radiation therapy technologist. The work covers the external beam treatment modality, including simulation and initial set-up tasks and treatment tasks. We also cover some tasks related to interstitial and intracavitary radiation, the preparation of accessories such as molds, shells, and contours, and some peripheral tasks dealing with support activities, calculations and record keeping.

In the area of external beam radiation therapy we cover megavoltage equipment such as the betatron and linear accelerator, which have x-ray and electron beam modalities, and cobalt-60 gamma ray teletherapy.

We cover superficial and deep x-ray machines when these are still indicated in current literature, isocenter capabilities for arc and rotation techniques or for setting up stationary fields, and pin and arc and back pointer devices when isocenter technique is not available.

Some of the tasks cover nursing-type functions, film processing, housekeeping, and administrative or clerical functions. However, we made no attempt to fully cover all the departmental work in these areas. We have also consciously omitted quality assurance, calibration of equipment, equipment testing and maintenance, dosimetry, teaching, most supervisory tasks, and many clerical activities. Models for some of these appear in Research Report No. 7 in connection with diagnostic radiology. Some areas were omitted simply because we did not have the money or time to deal with them; these include dosimetry and equipment testing. It should also be understood that the work of the radiotherapist or resident is omitted, as is most of the work in interstitial and intracavitary implantation, since technologist-level activities are not concentrated in those functions. Preparing pre-loaded applicators is also omitted due to lack of time, although this task can appear at the technologist level.

Some of the tasks we have included as technologist tasks may be carried out in some institutions by higher-level staff, and in some by lower-level staff. Some of the tasks covered can be assigned to persons with different job titles. We do not recommend the assignment of tasks to job levels or titles in Research Report No. 9. Research Report No. 10 reports on the results of the skill and knowledge analysis, and deals with the assignment of tasks to job levels.

Collection

The work of collecting the task identifications and descriptions was originally begun at Montefiore Hospital and Medical Center in New York City; we then determined that it was important also to include the work done in a major cancer center. We found that work assignments and task arrangements can differ by location and can reflect different background training. Thus, we collected our task data both at Montefiore and at Memorial Sloan-Kettering Cancer Center in New York City. We began our work in 1973 with a single team of analysts, but suspended work to concentrate on diagnostic radiology. As a result, most of the final work was carried out in 1976, and involved two teams of HSMS analysts.

While the initial task work was obtained by interview and observation of performers at Montefiore and Memorial Hospitals, the task descriptions were revised and expanded to include generic and optimal procedures not necessarily found in the field. These were gleaned from recent textbooks written for the radiotherapist but implying the technologist function, in-house materials found at the hospitals, and reports of conferences sponsored by government agencies dealing with radiotherapy practices and objectives.

It became clear after we had been at the work for some months that there is much less uniformity of practice in radiotherapy than in diagnostic radiology. We also found that, at the technologist level especially, few textbooks exist which present the work in detail. We have the impression that there is a range of functions possible for the technologist; technologists may have major responsibility under supervision for simulation and initial treatment set-ups, may set up for and administer external beam radiation treatments, and may fabricate molds, shells and casts; but sometimes they may be limited solely to simple support functions in simulation and treatment, and carry out narrow, discrete functions according to predetermined steps and standards.

Technologist training requirements reflect the diversity of practice. Only in recent years has there been an educational separation of the therapy function from the diagnostic function at the technologist level. Formerly, radiologic technologists received radiotherapy training within the approved (AMA-accredited) two-year radiologic technologist program. On-the-job training was expected to take care of the rest.

Currently, there are one-year AMA-approved programs in radiation therapy for radiologic technologists or registered nurses and two-year AMA-approved programs for beginning radiotherapy students. However, there has been no systematic review of what overlap exists in the work or what can be eliminated in the training of the therapy technologist if he or she has been trained as a radiologic technologist or as a nurse. (One presumes there would be different overlaps for radiologic technologists and for nurses.) This report and Research Report No. 10 are an attempt to shed some light on these questions.

Desiderata

As a result of the lack of uniformity of work and differing levels of tasks assigned to the radiation therapy technologist, we have had to make some decisions about the way we would present the task descriptions, how we would break down the tasks, and about the practices we would emphasize. HSMS takes sole responsibility for the following decisions, which reflect our "desiderata."

We chose to show tasks for which maximum training at the technologist level would be required so that there would be material available for the design of curricula at such levels. Thus, the simulation and treatment tasks require a broad and detailed knowledge of the field and call for high levels of responsibility. On the other hand, we also present some tasks in simulation and treatment which reflect the fact that technicians can be used solely to carry out support functions.

We chose not to have separate tasks for external beam treatment set-up and for administration of the radiation treatment dosage. Since two different performers could divide these responsibilities, our definition of task[2] could result in different tasks. However, we apply our criterion that one task is involved if the separation into two would endanger the quality of the output. We believe that setting up for and administering treatment requires the attention of a single performer so that the process can be interrupted and adjustments made if there are any movements of the patient or problems with the equipment; we believe that otherwise the patient is endangered.

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[2] See below later in this chapter.

The HSMS definition of task provides guidelines for the differentiation of one task from another in a specific function such as treatment tasks or simulation tasks. The guidelines suggest a breakdown to reflect what a single performer can be required to carry out with regard to a given output. This usually reflects the way the knowledge in the field breaks down and also reflects the way work is assigned. For example, in diagnostic radiology it is clear that, for the radiologist, the examination tasks break down by system of the body and procedure type, so we can easily distinguish that conducting a lower gastrointestinal tract, barium enema examination is one task, and conducting bronchography is another task. Different persons could be asked to perform each; and doing one task does not involve or require doing the other, does not depend on the performer having done the other, nor are they alternatives during performance.

In the case of radiation therapy technology,we found that some technologists are assigned work on the basis of the equipment used. Technologists exist who only administer treatment on a linear accelerator or only on a cobalt-60 teletherapy machine. In other instances, technologists are expected to administer treatment to a given patient and to be prepared for the possibility that a treatment plan may combine treatment using cobalt-60 with electron beam radiation or in some other combination.

We could have presented a double set of tasks, one set reflecting the equipment and another set reflecting the area of the body involved. Instead, we chose to present tasks that reflect a breakdown based on the area of the body. We reason that the patient receives continuity of attention if the technologist is prepared to deal with the given patient regardless of the machine. There is a need to monitor the patient's behavior and reactions to treatment over time, and the patient needs a supportive human environment, implying continuity of attention.

We thus endorse a broader, deeper type of training for the technologist than is reflected in a task breakdown based on equipment specialization. This approach has obvious implications for curriculum design and instructional planning.

Other decisions that reflect our bias with regard to desirable practice include the following:

1. We include in our task descriptions an emphasis on accuracy checks, such as the use of the light system, the cross method, and triangulation marks for simulation and set-up. We have all measurements and decisions recorded.
2. We include systematic provision of treatment verification films within the treatment tasks as an ongoing check on the actual treatment field set-up and geometry being done.
3. We always have the patient's identity verified.
4. We have the performer treat the patient with sympathy and dignity, and provide the patient with information about what is going on or will go on in the procedure. The performer monitors the patient's physical, emotional, and behavioral state, reports unusual changes, provides information on symptoms the patient should report, and reports missed appointments.

5. We have the performer arrange to have the patient constantly attended, with the performer responsible for seeing that the patient goes to the next appropriate location after the procedure is over.

TASK IDENTIFICATION AND DESCRIPTION

The full-scale HSMS method begins with identification of all the work units in the area being studied, regardless of the job titles in which they are found. We call the work units "tasks." The method avoids assigning tasks to titles or levels until it is clear what the work units are. Only at a later stage do we determine the skill and knowledge requirements and the relative levels of the tasks. The work in task identification and description is done in a multi-stage process by HSMS job analysts who work in teams.

For the short-cut method, an HSMS team first determines how many people it would have to cover to have access to every kind of work to be described (done by radiation therapy technologists or others at the technologist level). In the case of radiation therapy, this was when we learned that we would have to cover a major cancer center as well as a major hospital center, and that the areas of mold technology and intracavitary radiation had to be covered.

With each "performer" interviewed the analysts first obtain an idea of all the work covered by that individual. The analysts then apply the HSMS definition of task (discussed later in this chapter) to break the work down into specific task units, making sure that nothing is left out. This is the task identification stage.

In the short-cut HSMS method, task identification is the stage at which we can first determine how the tasks can be grouped by function, and what those functions are, such as simulation tasks, radiation treatment tasks, and nursing tasks. For each such major function we decide the basis on which to differentiate one task from another. In the short-cut method we then determine whether one or two models can be written for a function with the remaining tasks in the group summarized and referring back to the models.

Once all the tasks are identified, the team of analysts reviews a listing of all the HSMS tasks already identified and described, regardless of location. The analysts make note of any tasks on the list which seem exactly the same as any that are newly identified. The task descriptions of these already-identified tasks are checked in the field, and, if a task description applies, the same code number is assigned, and an "overlap task" exists. Its description and skill and knowledge requirements are already known, and no more work is needed for the task.

If the list and reading of existing task descriptions produce tasks that are similar to the ones newly identified, but with some differences in specific elements and/or skills or knowledge, the prior descriptions are used as models for the new task descriptions, and new code numbers are assigned.

To fully describe the new tasks, HSMS job analysts interview and sometimes observe performers at the institution. They write the descriptions of how the tasks are done, including contingencies, alternative approaches, and emergencies that could arise in the tasks.

While this is going on, the HSMS Director and the analysts are also reviewing current professional literature in the field. We collect as much material as we can describing the work being studied, such as articles in professional journals, textbooks, operators' manuals describing equipment, current relevant state and federal legislation, proceedings of conferences dealing with safe and/or quality practices, and related issues of patient care. We also have informal talks with professionals, educators, and people in government agencies. As a result, an overview emerges concerning procedures and activities which should be presented as tasks or within task descriptions, even if not always represented in current practice. We call these "desiderata."

The task descriptions are first written by the HSMS analysts and then go to the HSMS Director for review and editing. The task identifications are critically reviewed for conformity to the HSMS definition, and, when necessary, the analysts are sent back to the field to obtain additional information. At this stage the tasks are rewritten to incorporate findings on alternatives, contingencies, and desiderata.

In the brief version of the method, full task descriptions are written for only one or two tasks in a group of tasks that have elements and sequences in common. This becomes the model, and it is then determined what the elements and sequences are that the tasks share. These are written as summaries. Then the features unique to each given task are identified and described, based on the literature and the analyst's descriptions. Task summaries that are not based on models are done just like task descriptions, except that the activity of each task element is named rather than described.

The next phase involves critical review by professionals other than the performers who were interviewed by the HSMS analysts. The reviewers are asked to evaluate the task descriptions and/or summaries for correctness of language and sequence of procedures, to note omission of any tasks in the specialty area, and to indicate acceptable alternative methods. Reviewers are asked to concentrate on how the tasks should be done and also to reflect national practice.

After the tasks are reviewed, the suggested changes are incorporated. Additional tasks are collected and described when necessary, and any new or totally revised tasks are resubmitted for review as described here. When a task has been reviewed by at least three "respondents" and revised as required, it is referred to as a "normative task," or an "N task," and is so marked.

The reader will note that the collection of task descriptions is not like a sample survey. A sample survey would cover the same work at many locations and arrive at information on frequency and distribution. We start with a single location that would give us the widest coverage for our area of interest, and add locations only if some of the work is missing at the original location. (We ask our reviewers to indicate any missing areas of work.) We deal with and represent each unit of work only once, since we are interested in describing approved practice.

The HSMS objective in task description is to present all approved work procedures for a given area for the purposes of developing instructional materials, curriculum objectives, and career ladders. For such purposes we cover, not just the most typical tasks; we wish to cover the accepted but rare or difficult procedures, the emergencies, the contingencies, and the best possible practice. Since we are normative in approach as well as descriptive, we do not require data on how the work is usually done; rather, we require information on what the work is, and how it should be done.

THE HSMS DEFINITION OF TASK

In the HSMS view, each work activity needed to produce products, whether goods or services, requires labor that will combine and apply existing technology, knowledge, materials, and equipment with skills to produce the units of output. The HSMS unit of work is the "task." The HSMS definition of task is designed to result in the identification of a unit of work which can be moved from one job to another without disrupting other activities. The task is a unit of work which is conceptually smaller than a job as a whole, but it is large enough to have an identifiable, usable output which can be independently consumed or used, or which can serve as an input in a further stage of production by an individual other than the performer.

The steps of the task, or elements, unlike the task, do not have an identifiable output usable by someone other than the performer. The HSMS task definition is as follows:

> A task is a series or set of work activities (elements) that are needed to produce an identifiable output that can be independently consumed or used, or that can be used as an input in a further stage of production by an individual who may or may not be the performer of the task.

In order to facilitate use of the definition, HSMS analysts use the following rules:

1. In principle, someone other than the performer of the task must be able to use or consume the output of the task.
2. Theoretically, it should be possible for there to be an elapse of time between tasks.
3. A task includes all the possible conditions or circumstances with which a single performer is expected to deal in connection with the production stage or the output involved.
4. A task includes all the elements that require continuous judgment or assessment by the same performer in order to assure the quality of the output.
5. A task includes all of the elements needed to produce an output which can be independently used or acted upon without special explanations to the next performer in the next stage of production.
6. A task includes all the elements needed to complete an output to a point at which another performer (who would continue with the next production sequence) would not have to redo major elements or perform extra steps in order to continue.
7. The task must include enough alternative minor elements so that another performer can continue with the next stage in a production sequence within current institutional arrangements.
8. A task must be sufficiently broad in statement that it can be rated on its frequency of occurrence.

READING THE TASKS

The detailed task descriptions presented in Chapters 3 and 5 follow the format presented in Figure 1,the HSMS Task Description Sheet. At the top right is the task's Code Number. A code number is assigned to each task; this stands uniquely for the contents of the task, covering the task's output, what is used, the kind of recipient or respondent dealt with, and how the task is done. Regardless of the job title, institution, or industry in which the task is found, it will always have the same code number. The number itself has no intrinsic meaning.[3]

The basic aspects of the task appear in items 1 through 4,on the left on page 1 of the Task Description Sheet. These help the analysts focus during the task identification stage and help differentiate one task from another. The term "output" is used to mean the result of an independent stage in a larger process of production in an institution, assuming the current organization of work activities. "What is used" in a task includes all the things which the performer is expected to be able to use or choose from to produce the identified output.

The "recipient, respondent or co-worker" involved in a task reflects the special characteristics or condition of the people with whom the performer must be trained to deal. For example, certain procedures

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[3] The reader will find that some tasks, such as administrative and nursing tasks, are generic and can be found in many departments. They have been written intentionally to be picked up and recognized wherever they may appear. A given task that appears in different jobs, departments, or institutions is an "overlap" task. It always has the same code number.

Figure 1.

HSMS TASK DESCRIPTION SHEET

Task Code No. _____

This is page 1 of ___ for this task.

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

3. Is there a recipient, respondent or co-worker involved in the task? Yes...( ) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

List Elements Fully

6. Check here if this is a master sheet..( )

are carried out in the same way for all patients. These are "any patient" tasks. In some cases a task is only applied to a given type of patient, such as a male patient, or a pediatric patient.

The "name of the task" (item 5 on the Task Description Sheet), summarizes the task in a paragraph-length statement. This is the "extended task name." The underlined portion of the statement is referred to as the "abbreviated task name."

Under the Task Code Number at the top of the page, the reader is told the number of pages that the task runs in the statement, "This is page ___ of ___ for this task." All tasks that bear the notation "OK-RP; RR;RR" at the lower right and are checked as master sheets on the first page are "N" tasks. Such tasks have had the required minimum of three reviewers and are "normative" tasks.[4]

The description of how the task is done begins with the column on the right on the first Task Description Sheet and continues for as many pages as necessary on "continuation sheets."

As the work progressed, we developed certain language conventions of which the reader should be aware for ease of comprehension. These are briefly described as follows:

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[4] RP stands for resource person, i.e., the in-house reviewer; RR stands for resource respondent, i.e., outside reviewer. In actual practice, these merely record three reviewers; additional reviewers are not recorded on the sheet.

1. The person doing the task is always referred to as the "performer" regardless of his or her usual job title or rank. This provides a standard format and leaves for a later stage any battles over who should do what.

2. The task always begins with an initiating element that indicates how it comes about that the performer is doing the task.

3. The same or similar activities tend to be described with similar language wherever these appear, to assist analysts in spotting elements that overlap from task to task. This facilitates curriculum development even if it makes for dull reading. In the short-cut version of the method overlap elements are eliminated in the task summaries,and reference is made to the model tasks which have full descriptions.

4. Each task in the full-scale method is written so that it is complete within itself. Therefore, there is repetition from task to task. In the short-cut method the repetition is minimized in summary tasks.

5. Certain phrases should be interpreted by the reader as indicating that another task has been generated by virtue of this task. Phrases such as "performer arranges...,","performer has...[done]" are examples.

6. When a task may either be done by the performer or delegated, a separate task is generated. The signal for such tasks are phrases such as "....or decides to do personally," "performer plans to...," or "performer may decide to...."

7. When a particular part of a task represents an element that may or may not be done depending on institutional practice, personal preference, the state of the art, or the patient's condition, we use the phrase "performer may" or "may" before the description. Where the performer must make a choice as part of the task, we have tried to make that explicit: "performer decides," "performer considers whether..."

8. The specific content of some steps in a task, such as the choice of materials,or equipment,or information considered may vary as the state of knowledge in the field changes or as new technology develops. There may be variations which reflect the condition of the patient, the equipment used, institutional facilities, or what was already done. There may also be variation of choices or steps reflecting current controversy or personal preference. We do not attempt to

> present all the alternatives or to resolve these problems; we simply acknowledge them. Thus, the reader will find the phrase "as appropriate" in many steps. The phrase is used to cover these contingencies. We leave it to the instructor to select what is "true" or "correct" at any point in time, and insert the "appropriate" content.

The task summaries presented in Chapters 3 and 5 follow the format presented in Figure 2, the HSMS Task Identification Summary Sheet. The task's Code Number is presented at the top left. There is provision for counting the number of tasks for a given performer at the top right. The heading includes space to enter information related to the performer's name, job title, department, and institution, as well as the job analyst(s)' name(s) and the date. (We leave these blank in this document.) The right-hand column begins the list of elements; these are also continued on "continuation sheets." All other features are exactly the same as those in Figure 1. These forms are also used in the full-scale method when we first collect the data and present the task descriptions for review.

The extended task names presented in Chapters 3 and 5 are the equivalent of item 5, on the left in Figures 1 and 2, with a code number assigned. The abbreviated task names presented in Chapter 6 are the underlined portions of the extended task names.

The reader should be aware that, though the tasks in Chapters 3 and 5 are presented in numerical order by code number, not every number is represented. The first code number is Code 69; the last is Code 639. There are only 124 tasks represented in this Report. This is because Task Code Numbers are assigned in sequence as the tasks are processed, and

Figure 2.

HSMS TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
This is page 1 of ___ for this task.

Performer's Name________________________ Analyst(s)________________________ Dept.__________
Job Title________________________ Institution________________________ Date__________

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

3. Is there a recipient, respondent or co-worker involved in the task? Yes...( ) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

List Elements

6. Check here if this is a master sheet..( )

other tasks which appeared in prior reports were assigned Numbers 1 through 560. Code Numbers lower than 561 found in this report indicate overlap with prior tasks found in our ambulatory care pilot study and/or in diagnostic radiology. There are 79 new and 45 overlap tasks in this report.

USES OF THE TASK DESCRIPTIONS AND SUMMARIES

The task descriptions and summaries are offered for use as instructional materials, as inputs to the design of career ladders, for the structuring of jobs, the assignment of tasks to job titles, for the development of curriculum objectives, and as inputs to the development of performance evaluation instruments and proficiency tests. The material can also be used for human resources development, planning, and counseling. Below is a summary of some of the uses:

1. The task descriptions and summaries can be used as instructional materials in the classroom and in clinical training. They provide ordered, logical sequences of steps. They suggest what contingencies, options, and emergencies are associated with the tasks, and, for the less familiar specialties, an indication of what is done in a given procedure.

2. The task descriptions and summaries can be used in the development of team training, since they refer to others in the procedures.

3. The task descriptions and summaries can provide an introduction to, or a basis for evaluation of, safe practice; they can be used to check on whether desired objectives are being accomplished by checking on whether required steps or tasks are being carried out.

4. The task identifications, when combined with HSMS skill and knowledge data, are inputs to the HSMS method of designing job ladders and/or assigning tasks to occupational levels and titles.

5. The task descriptions and summaries, when combined with the HSMS skill and knowledge data, can become inputs in the development of performance-based curriculum objectives and educational ladders.

6. The task descriptions and summaries can be used as references for evaluation of work performance or as inputs to the development of job relevant proficiency tests (particularly for the selection of test content once the skill and knowledge data are collected).

7. The task descriptions and summaries can be used as objective references for the development of job descriptions, especially when edited to reflect the practices at a given institution.

8. The task descriptions can be used in occupational counseling and for purposes of consumer education.

9. The "extended task name," which summarizes the task in a paragraph-length statement, is sufficiently long that ambiguity is avoided when there is a need to quickly grasp the contents of a task for reference purposes. These are usable for task inventories.

10. The "abbreviated task name," which indicates the key features of the task, is most useful for simple listings and task inventories.

CHAPTER 2

ABBREVIATED TASK NAMES IN RADIATION THERAPY TECHNOLOGY BY FUNCTION AND CODE NUMBER

TASKS LISTED BY TASK FUNCTION

Category and Abbreviated Task Name	Task Code No.
SIMULATION AND INITIAL SET-UP TASKS	
Carrying out simulation and/or initial set-up for any patient to receive external beam radiation therapy of the head, neck, and/or spinal column, using simulator or treatment machine.	563
Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the thorax, such as lungs, pleura, esophagus, mediastinum, using simulator or treatment machine.	564
Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the breast(s), using simulator or treatment machine.	565
Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the lymph nodes with mantle and/or "inverted-Y" field techniques or variations,using simulator or treatment machine.	566
Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the whole abdomen, or female patient to receive external beam radiation of the reproductive system, using simulator or treatment machine.	567
Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the whole pelvis, urinary bladder, or male patient to receive external beam radiation of the prostate, using simulator or treatment machine.	568
Carrying out simulation and initial set-up for male patient to receive external beam radiation therapy of the testis, using simulator or treatment machine.	569

TASKS LISTED BY TASK FUNCTION (continued)

Category and Abbreviated Task Name	Task Code No.
SIMULATION AND INITIAL SET-UP (continued)	
Carrying out simulation and initial set-up for male patient to receive external beam radiation therapy of the penis, using simulator or treatment machine.	570
Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the kidney and/or adrenal glands or neuroblastoma, using simulator or treatment machine.	571
Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the bone and/or soft tissue of an extremity, using simulator or treatment machine.	572
Carrying out simulation and/or initial set-up for any patient to receive external beam radiation therapy of the whole body.	573
TREATMENT TASKS	
External Beam	
Setting up any radiotherapy patient and administering external beam radiation therapy to the head and/or neck and/or spinal column.	599
Setting up any radiotherapy patient and administering external beam radiation therapy to the thorax, for treatment of lungs, pleura, esophagus, or mediastinum.	600
Setting up any radiotherapy patient and administering external beam radiation therapy to the breast(s).	601
Setting up any radiotherapy patient and administering external beam radiation therapy to the lymph nodes with mantle and/or "inverted-Y" field techniques or variations.	602
Setting up and administering external beam radiation therapy to whole abdomen of radiotherapy patient or female patient to receive external beam radiation of the reproductive system.	603

TASKS LISTED BY TASK FUNCTION (continued)

Category and Abbreviated Task Name	Task Code No.
TREATMENT TASKS	
External Beam (continued)	
Setting up and administering external beam radiation therapy to the whole pelvis or urinary bladder of a radiotherapy patient or male patient to receive external beam radiation of the prostate.	604
Setting up a male radiotherapy patient and administering external beam radiation therapy to the testis.	605
Setting up a male radiotherapy patient and administering external beam radiation therapy to the penis.	606
Setting up any radiotherapy patient and administering external beam radiation therapy to the kidney and/or adrenal glands.	607
Setting up any radiotherapy patient and administering external beam radiation therapy to the bone and/or soft tissue of an extremity.	608
Setting up any radiotherapy patient and administering external beam radiation therapy of the whole body.	609
Remote Afterloader	
Taking localization radiographs and administering intracavitary radiation therapy with remote afterloader to any internal radiation therapy patient.	622
Localization With Diagnostic Equipment	
Taking tomograms of non-infant patient.	374
Taking transverse axial tomograms of any patient.	575
Taking computerized transverse axial tomographic (C.T.T.) scans of any patient.	526

TASKS LISTED BY TASK FUNCTION (continued)

Category and Abbreviated Task Name	Task Code No.
TREATMENT TASKS	
Localization With Diagnostic Equipment (continued)	
Taking localization films of intracavitary applicator or interstitial implant prior to treatment of a radiation therapy patient.	619
FABRICATION OF TREATMENT ACCESSORIES	
Preparing a contour drawing at the appropriate treatment level(s) of any patient to receive external beam radiation therapy.	574
Fabricating a treatment shell or mask of plaster of Paris bandages using direct technique for radiotherapy patient.	582
Fabricating a treatment mold or applicator or solid cast for radiotherapy patient from dental impression compound, and/or plaster of Paris, or liquid resin acrylic, or stone plaster, using indirect technique.	583
Preparing an intracavitary or surface applicator mold to receive radioactive sealed sources.	584
Preparing a solid cast of plaster of Paris or stone plaster for use as model in treatment planning or for shaping lead shields.	585
Forming a plastic radiotherapy treatment shell from a solid or positive cast of plaster of Paris or stone plaster, using a vacuum forming machine.	586
Making an intraoral or surface stent or dental wax cast impression of a radiotherapy patient.	587
Fabricating a bite-block or other radiotherapy treament mold from a wax cast.	588
Preparing a lead bite-block or other lead block for radiotherapy use from a wax cast set in plaster mold.	589
Applying wax bolus to a radiotherapy treatment shell.	590

TASKS LISTED BY TASK FUNCTION (continued)

Category and Abbreviated Task Name	Task Code No.
FABRICATION OF TREATMENT ACCESSORIES (continued)	
Fabricating lead shielding for radiotherapy treatment fields.	591
Fabricating and shaping radiotherapy lead shielding or mask cutouts on a plaster cast of radiotherapy patient.	592
Cutting treatment portals out of radiotherapy treatment shell.	593
Fabricating a contact or spatula-type internal eye shield for radiotherapy.	594
Fitting a radiotherapy treatment shell to a patient, fixing to supports and/or attaching straps.	595
Preparing and/or arranging external beam radiotherapy beam blocks or compensating filters of prescribed shape and HVL for use in shadow tray.	596
Fabricating radiotherapy styrofoam molds for beam blocking using marked radiograph, treatment geometry and a hot wire cutting device.	597
Fabricating customized lead radiotherapy shielding beam blocks with styrofoam molds.	598
EQUIPMENT-RELATED TASKS	
Transporting sealed radioactive isotopes within institution from storage to treatment area safes following appropriate safety precautions.	621
Retrieving, displaying and making photographs, printouts and/or magnetic tape records of computerized transverse axial tomographic (C.T.T.) scans.	527
Preparing external beam treatment equipment with appropriate attachments.	612
Checking, preparing fluoroscope controls (and phototimer).	178

TASKS LISTED BY TASK FUNCTION (continued)

Category and Abbreviated Task Name	Task Code No.
EQUIPMENT-RELATED TASKS (continued)	
Processing exposed x-ray film in automatic processor.	69
Processing exposed Polaroid x-ray film with Polaroid automatic processing equipment.	267
Loading x-ray film cassette(s), nonscreen film holder(s), box(es), and/or roll film cartridges.	72
Loading empty cassette with Polaroid x-ray film.	269
Preparing barium sulfate contrast medium as ordered for standard use.	79
Preparing materials or trays with medications and materials for special treatments or procedures according to standard orders.	80
Adding predetermined instruments and supplies to prepared procedure trays.	274
Applying print coater to photographs.	319
PATIENT CARE, ASSISTANCE TASKS	
Providing emergency care for any patient having adverse reaction to radiographic contrast medium, procedures, or accident.	77
Applying lead contact or spatula-type internal eye shield under any radiotherapy patient's eyelid.	577
Inserting radiopaque probe into female patient's vagina to localize tumor or cervix.	578
Inserting balloon catheter or barium enema in any patient's rectum to localize tumor or rectum.	579
Catheterizing any male or female patient's urethra with retention balloon catheter.	181
Catheterizing any female urethra as ordered.	143

TASKS LISTED BY TASK FUNCTION (continued)

Category and Abbreviated Task Name	Task Code No.
PATIENT CARE, ASSISTANCE (continued)	
Setting up and using suction machine to clear airway or to assist with gastric lavage.	182
Administering medication orally to any patient according to MD's orders.	294
Administering medication orally to any patient according to MD's orders after having quantity checked.	198
Assisting as ordered with localization, simulation and/or initial set-up procedures for any patient to receive external beam radiation therapy, using simulator or treatment machine as ordered.	576
Assisting radiotherapist in application and/or removal of intracavitary applicator for remote or conventional afterloader radiation treatment of any patient.	620
Reassuring any radiotherapy patient and/or accompanying family member about external beam radiotherapy procedures.	610
Reassuring any radiotherapy patient and/or accompanying family member about intracavitary, or interstitial implant, or instillation, or remote afterloader procedures.	616
Explaining to any out-patient or accompanying family member proper at-home procedures to follow prior to coming for radiation therapy treatment.	611
Reinforcing or informing internal radiation therapy patient about expected reactions to therapy, self care, and danger signs to report.	618
Administering eye or ear drops to any patient on orders.	194
Applying an eye patch for any patient on orders.	195
Mummying or wrapping an infant or young pediatric patient.	490
Escorting adult out-patients to and/or from dressing rooms, treatment rooms and/or waiting areas.	282
Assisting patient to or from wheelchair, stretcher, bed, or table and/or transporting patient to designated area.	190

TASKS LISTED BY TASK FUNCTION (continued)

Category and Abbreviated Task Name	Task Code No.
PATIENT CARE, ASSISTANCE (continued)	
Taking photograph(s) of any patient's face and/or treatment areas as ordered.	580
CALCULATIONS	
Calculating and recording, or checking and reporting errors in calculations, in external beam radiation treatment plan or in therapy chart, such as effective area, dose time or monitor units, central axis depth dose, prescribed total tumor dose versus total given dose, according to predetermined formulae, using appropriate information.	613
Adding and recording accumulated given doses and/or weekly final tumor doses, or checking and reporting calculation errors, in radiotherapy treatment charts.	614
Calculating treatment time for remote afterloader intracavitary radiation treatment or checking calculation.	617
PLANNING, ADMINISTRATIVE TASKS	
Participating in discussion on, or answering questions about, external beam radiation therapy equipment in relation to proposed treatment plan.	562
Planning and arranging for pre-treatment procedures for external beam radiation therapy.	561
Planning and arranging procedures for intracavitary or interstitial radiation therapy (brachytherapy).	615
Discussing, planning and arranging for mold room procedures to fabricate treatment devices such as shells, casts, masks, applicators, beam blocks, bolus, shields, etc., for use in radiation therapy.	581
Making assignments of staff to work areas, procedures, and/or MD's and/or vacations and lunch hours.	131

TASKS LISTED BY TASK FUNCTION (continued)

Category and Abbreviated Task Name	Task Code No.
PLANNING, ADMINISTRATIVE TASKS (continued)	
Arranging to cover temporary or permanent staff shortages.	124
Preparing and adjusting schedules for patient procedures.	272
Assigning subordinate and explaining assignment to transport patient, obtain materials or documents, or assist co-worker.	294
Having any patient and materials prepared for special procedure and readying patient for examination.	193
Deciding on and/or arranging for transportation for out-patient to and/or from treatment or examination.	116
Checking on reasons for non-appearance of out-patients for examination or treatment and arranging for rescheduling.	159
Checking on reasons for nonappearance of in-patients for examinations or treatment.	278
Orienting new staff member(s) to departmental standard operating and administrative procedures, floor plan, location of equipment and supplies, record keeping.	186
INVENTORY AND CLERICAL TASKS	
Checking supply and ordering non-narcotic medicinals needed by department.	129
Checking supplies and ordering non-drug materials needed by department.	76
Checking and storing order for non-narcotic drugs and/or supplies.	136
Logging and/or tallying patient services and/or instructional case record materials for use in record keeping, billing or instruction.	134
Obtaining patient records for use in examination, procedure, treatment or conference.	354

TASKS LISTED BY TASK FUNCTION (continued)

Category and Abbreviated Task Name	Task Code No.
INVENTORY AND CLERICAL TASKS (continued)	
Filing or obtaining records from files by patient identification number and/or name.	265
Filling out patient identification information on labels and forms in anticipation of need or as requested.	164
HOUSEKEEPING TASKS	
Preparing treatment or examination room(s) for use.	151
Cleaning an examination or treatment room after use.	135
PERSONAL EXPOSURE MONITORING TASKS	
Participating in monitoring of personal exposure to radiation by periodically turning in and replacing film strip in badge; evaluating exposure listings.	327
Participating in monitoring of personal exposure to radiation by periodically turning in and replacing film strip in badge worn by performer.	280

CHAPTER 3

TASK DESCRIPTIONS, SUMMARIES AND EXTENDED TASK NAMES: RADIATION THERAPY TECHNOLOGY

There are 105 task descriptions, task summaries and extended task names included in this chapter. These are arranged numerically by Task Code Number from Code 69 to Code 622. Extended task names for which task descriptions appear in Volumes 1, 2 or 3 of Research Report No. 7 are so indicated, with the volume number entered in the column on the right. Extended task names which overlap with tasks in ambulatory care (identified during an HSMS pilot test), for which there are no task descriptions, are indicated by an asterisk to the left of the task's Code Number. Pagination appears at the top of each page.

TASK CODE	EXTENDED TASK NAME	RR #7 VOL. NO.
69	Processing exposed x-ray film in automatic processor by working under safelight; unloading film holder(s); transferring identifying information to film using flasher; adjusting temperature and timer if appropriate; splicing small size film to leader film; inserting in machine; placing for use or on view boxes; marking missing identification information after processing; reporting or deciding to investigate processing problems.	3
72	Loading x-ray film cassette(s), nonscreen film holder(s), box(es), and/or roll film cartridges by working under safelight; obtaining appropriate film type, speed, size; matching with cassette, intensifying screen(s), or nonscreen holder; inspecting, cleaning or replacing intensifying screens; inserting film(s) in holder(s); placing or delivering for use.	3
76	Checking supplies and ordering non-drug materials needed by department by filling out or having co-worker fill out standing orders; taking inventory and ordering items below par levels;	3

(continued)

TASK CODE	EXTENDED TASK NAME	RR #7 VOL. NO.
76	(Continued) noting or asking for requests for items; filling out requisition form or outside order form in duplicate; having orders delivered or placed for pick-up.	
77	Providing emergency care for any patient having adverse reaction to radiographic contrast medium, procedures, or accident by assessing cause, nature, and severity of the reaction; using emergency care equipment to provide life support procedures and/or palliative medication; deciding whether procedure should be terminated; recording; terminating if appropriate; arranging to have patient sent to emergency room or hospitalized if appropriate.	3
79	Preparing barium sulfate contrast medium as ordered or for standard use by noting purpose, ingredients, proportions; obtaining materials; measuring and/or mixing solution or paste to be ingested under sterile conditions, or mixing ingredients for enema; assembling and clamping; hanging enema at appropriate height or placing contrast materials for use.	3
80	Preparing materials or trays with medications and materials for special treatments or procedures according to standard orders by obtaining order cards, filling trays or supplementing standard trays with medical supplies; measuring out medicinals and preparing solutions; deciding to do preparation of injections or ordering; checking emergency cart for supplies; covering prepared tray; placing for use or informing co-worker when materials are ready.	3
*116	Deciding on and/or arranging for transportation for out-patient to and/or from treatment or examination by obtaining and reviewing request and relevant information; explaining refusal or making out request form; recording and/or notifying patient or person requesting of refusal or arrangements as appropriate.	
*124	Arranging to cover temporary or permanent staff shortages by discussing and obtaining changes in vacation plans and/or overtime; filling out requisitions for temporary or summer replacements; filling out requisitions for permanent replacements, as appropriate.	
129	Checking supply and ordering non-narcotic medicinals needed by department by filling out standing orders; taking inventory and ordering items below par levels or expired; noting or asking for requests for items; filling out requisition form or outside (continued)	3

TASK CODE	EXTENDED TASK NAME	RR #7 VOL. NO.
129	(Continued) order card in duplicate; having expired medicinals returned and orders delivered or placed for pick up.	
131	Making assignments of staff to work areas, procedures, and/or MD's and/or vacations and lunch hours by assessing number of staff available, work load needs, need for rotation, considering experience and preferences; making assignments; filling out assignment sheet; placing for typing and/or posting; adjusting assignments to cover absences or latenesses on individual days.	3
134	Logging and/or tallying patient services and/or instructional case record materials for use in record keeping, billing or instruction by obtaining information to be logged and appropriate forms or log book; ascertaining the information to be entered and entering as appropriate; tallying; returning original records; placing log book, tally and/or forms for filing or use as appropriate.	3
135	Cleaning an examination or treatment room after use by throwing away disposable used materials; wiping away blood and stains using antiseptic solution; replacing linens on treatment table; replacing used or displaced materials; arranging for housekeeping service if needed; returning any documents left in room as appropriate.	3
136	Checking and storing order for non-narcotic drugs and/or supplies by checking against order; notifying supply department or outside supplier of missing items; distributing to units, individuals, and/or storing in designated labeled locations.	3
143	Catheterizing any female urethra as ordered by reassuring patient; assembling sterile equipment; preparing patient using sterile procedures; inserting catheter into urethra and bladder; reassuring patient or reporting excessive pain; collecting urine specimen, if appropriate; informing physician when catheter is inserted; telling MD when (if appropriate) catheter is held in place.	3
*151	Preparing treatment or examination room(s) for use by ordering cleaning; checking for proper quantities, whether materials are soiled or expired; restocking or arranging for restocking as needed; discarding expired materials; making sure that equipment is turned off as appropriate; replacing equipment in proper locations.	

TASK CODE	EXTENDED TASK NAME	RR #7 VOL. NO.
*159	Checking on reasons for non-appearance of out-patients for examination or treatment and arranging for rescheduling by finding out reasons from patient; reporting need for medical or social services to appropriate staff; arranging for transportation, visit or rescheduling as appropriate; recording in patient's chart.	
164	Filling out patient identification information on labels and forms in anticipation of need or as requested, by estimating need or referring to standard orders or request; getting information; filling in information; placing for use.	3
178	Checking, preparing fluoroscope controls (and phototimer) by turning on power; selecting mode; selecting and setting technical factors, examination timer, exposure timer, spot film device; checking automatic density control with mA indicator; checking kVp, TV monitor and mA settings by adjusting control dials; checking phototimer by noting whether, with spot filming, safety timer is needed or processed spots are too light; arranging for repair and shutting down unit if warranted; reporting, recording as appropriate.	3
181	Catheterizing any male or female patient's urethra with retention balloon catheter by reassuring; assembling sterile equipment; preparing patient using sterile procedures; inserting catheter into urethra and bladder; reassuring and/or collecting urine specimen; inflating balloon catheter with sterile water; attaching catheter to drainage or IV tubing; terminating and reporting if extreme pain or resistance is encountered; recording amount and appearance of urine collected; reporting when ready if appropriate.	3
182	Setting up and using suction machine to clear airway or to assist with gastric lavage, by obtaining materials and machine, preparing patient, checking machine, turning machine on and off as ordered for gastric lavage, or inserting catheter into tracheal opening and clearing airway; cleaning up afterwards.	3
186	Orienting new staff member(s) to departmental standard operating and administrative procedures, floor plan, location of equipment and supplies, record keeping by explaining, demonstrating, showing, giving copies of forms, rules and regulations, answering questions.	3

TASK CODE	EXTENDED TASK NAME	RR #7 VOL.NO.
190	Assisting patient to or from wheelchair, stretcher, bed, or table and/or transporting patient to designated area by positioning vehicle, making vehicle stationary during shift, supporting patient; transporting; notifying appropriate personnel when patient arrives; presenting any documents.	3
193	Having any patient and materials prepared for special procedure and readying patient for examination by reviewing orders; arranging to have materials and injections prepared, have vital signs taken, have medication administered; preparing patient on examination table; exposing relevant area of patient's body; swabbing with antiseptic; notifying physician or co-worker when ready.	3
*194	Administering eye or ear drops to any patient on orders by reviewing orders; obtaining proper medication from storage location; explaining to patient; positioning; instilling drops observing sterile technique; recording.	
*195	Applying an eye patch for any patient on orders, by obtaining patch; placing in position over proper eye of patient; checking on patient's comfort; recording.	
198	Administering medication orally to any patient according to MD's orders after having quantity checked by obtaining and measuring out proper medication and having it checked; checking on patient allergy; explaining use and/or side effects to patient; administering medication; filling out and signing proper forms if narcotic or regulated drug; recording medication given.	3
*265	Filing or obtaining records from files by patient identification number and/or name by obtaining information needed; going to proper files; checking information; pulling or inserting document(s) such as radiographs, test reports from files; placing for use or in patient's folder if appropriate.	
267	Processing exposed Polaroid x-ray film with Polaroid automatic processing equipment by inserting cassette; activating machine and removing when appropriate; separating positive film image from cover sheet; writing identification information on radiograph using marker; applying coater; placing to be viewed or filed.	3

TASK CODE	EXTENDED TASK NAME	RR #7 VOL. NO.
269	Loading empty cassette with Polaroid x-ray film by obtaining empty cassette and prepared radiographic packet; inserting film packet in cassette; closing, and placing for use away from any intense light.	3
272	Preparing and adjusting schedules for patient procedures by arranging requisitions by type of procedure and assigning times based on urgency, available staff, rooms, time needed for procedure(s), number of patients, and order in which procedures are done; assigning times to patients; recording and posting schedule; adjusting throughout day as appropriate.	3
274	Adding predetermined instruments and supplies to prepared procedure trays, by ascertaining procedure to be prepared for; referring to cards listing items to be added for procedures; obtaining items from storage; adding to trays and/or carts; if appropriate, labeling carts by procedure; covering trays with sterile towels; placing for pick-up or bringing to designated location.	3
278	Checking on reasons for nonappearance of in-patients for examinations or treatment by telephoning wards or floors, recording reasons; presenting complaint if appropriate; posting reasons in designated locations; notifying proper co-worker(s) of need to send someone to transport and/or to reschedule patient(s).	3
280	Participating in monitoring of personal exposure to radiation by periodically turning in and replacing film strip in badge worn by performer, or telling supervisor when performer thinks excessive exposure has occurred; discussing source of any excessive radiation exposure and possible need for transfer from work assignment if appropriate.	3
282	Escorting adult out-patients to and/or from dressing rooms, treatment rooms and/or waiting areas, by transporting if neccessary; explaining what to remove and what to put on; assisting in dressing and undressing if needed; keeping record of belongings placed in lockers; and returning belongings to patient.	3
294	Assigning subordinate and explaining assignment to transport patient, obtain materials or documents, or assist co-worker by evaluating need, choosing subordinate, explaining, and providing information needed.	3

TASK CODE	EXTENDED TASK NAME	RR # 7 VOL. NO.
298	Administering medication orally to any patient according to MD's orders by obtaining and measuring out proper medication, checking on patient allergy; explaining use and/or side effects to patient; administering; filling out and signing proper forms if narcotic or regulated drug; recording medication given.	3
319	Applying print coater to photographs, by obtaining materials; applying coater; placing to dry; writing identification information; placing dried prints for use.	3
327	Participating in monitoring of personal exposure to radiation by periodically turning in and replacing film strip in badge; evaluating posted exposure listings; discussing source of any excessive exposure found and/or what to do if personal exposure levels are near safety maximum.	3
354	Obtaining patient records for use in examination, procedure, treatment or conference by determining the patient records required; checking for presence of documents needed; ordering what is needed from appropriate department orally and/or with requisition sheet; arranging to have records delivered; placing complete set for use as appropriate.	3
374	Taking tomograms of non-infant patient by reviewing request; reporting observed contraindications; preparing equipment; reassuring patient; localizing lesion from plain films; setting up layer height, amplitude and technical factors for scout tomograms as ordered; providing shielding; positioning patient; collimating; identifying; exposing scout tomograms and arranging for processing; taking to radiologist; taking full set of tomograms, continuing as ordered; having patient returned; placing tomograms for use; recording examination.	2
490	Mummying or wrapping an infant or young pediatric patient by obtaining, preparing materials following sanitary procedure; folding sheet; placing patient on sheet; folding sheet under and over limbs on either side; continuing wrapping; securing; indicating when completed as appropriate; reassuring patient.	3
526	Taking computerized transverse axial tomographic (C.T.T.) scans of any patient by reviewing request; preparing equipment; setting technical factors, scan level; reassuring, preparing, positioning, immobilizing patient; providing shielding; running scans as ordered using appropriate controls; viewing scans; ad-	2

(continued)

TASK CODE	EXTENDED TASK NAME	RR #7 VOL. NO.
526	(Continued) justing viewer controls; making line print-outs, photographs of scan displays as ordered; recording scans on magnetic tape; presenting scans for review by radiologist; assisting with IV injection of contrast; continuing, repeating scans; recording, reviewing as ordered; having patient returned; placing C.T.T. scans for use; recording examination.	
527	Retrieving, displaying and making photographs, printouts and/or magnetic tape records of computerized transverse axial tomographic (C.T.T.) scans, by reviewing requests; preparing equipment; locating scans on disc or tape; viewing scans on display and adjusting as requested by radiologist or as ordered; making photographs of scan displays; making line printouts of scans; recording scans on magnetic tape, as ordered; presenting for review; discussing, continuing as ordered; placing scan records for use.	3

TASK DESCRIPTION SHEET

Task Code No. 561

This is page 1 of 4 for this task.

1. **What is the output of this task?** (Be sure this is broad enough to be repeatable.)

Decisions made on sequence of pre-treatment procedures to schedule for external beam radiation therapy such as localization films, contour, physics plan, construction of cast, shell,mold; selection of simulator or treatment machine for set-up planning; information recorded, placed for scheduling.

2. **What is used in performing this task?** (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Patient's medical chart or relevant medical information, diagnostic radiographs; proposed treatment technique;paper, pen or pencil; appropriate requisition sheets or forms; view boxes

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Radiotherapist; co-worker

5. **Name the task** so that the answers to questions 1-4 are reflected. Underline essential words.

Planning and arranging for pre-treatment procedures for external beam radiation therapy such as localization, simulation, set-up, manufacture of immobilization devices or set-up equipment, by reviewing proposed treatment machine, field arrangement, nature of tumor, patient's condition, type of localization needed and appropriate sequence of events; selecting appropriate procedures and arranging for scheduling, or placing information for scheduling.

List Elements Fully

Performer arranges for necessary pre-treatment set-up procedures called for in a proposed treatment plan for external beam radiation therapy after receiving the proposed treatment technique, related medical information and/or requisition forms from the radiotherapist or a co-worker.

1. Performer reads, reviews, and/or discusses the proposed treatment technique and notes the relevant information in order to judge what set-up and treatment planning procedures are required.

   a. Performer notes the patient's name, sex, height, weight and age. Notes whether patient is a new patient for whom treatment is to be planned or current patient whose treatment plan is to be modified. Notes whether patient is in-patient, outpatient, to be treated as emergency patient.

   b. If any records are missing, performer arranges to have them sent. Performer may review radiographs of tumor on view boxes.

   c. Performer reviews and/or discusses the patient's diagnostic material indicating the nature of the tumor, its estimated location, size and volume.

      1) Performer notes whether the treatment is for curative or palliative

OK-RP; RR:RR

6. Check here if this is a master sheet..(X)

TASK DESCRIPTION SHEET (continued)

Task Code No. 561

This is page 2 of 4 for this task.

List Elements Fully

purposes, whether the disease is considered terminal, and whether the therapy is to be done in conjunction with other modalities such as surgery, interstitial or intracavitary radiation, and/or chemotherapy.

ii) Performer notes or discusses whether the tumor is in close proximity to healthy, radiosensitive tissues.

d. Performer notes the machine and type of field arrangement selected:

i) Notes the machine selected for the type of tumor, such as a superficial x-ray machine, orthovoltage or conventional x-ray machine; megavoltage (supervoltage) equipment, such as betatron or linear accelerator (and choice of x-ray or electron beam), or teletherapy machine using radioactive isotopes as gamma ray source, such as cobalt-60 or cesium-137, depending on the equipment available.

ii) Notes the recommended field locations and arrangements for the treatment (whether stationary, such as single direct field(s), parallel opposed pair(s), moving strip fields, wedge-pair, multiple converging fields; or moving fields, such as arc or rotation), and the need for devices to direct or affect beam quality or shape and/or special shielding.

e. If tentative dose planning has already been done, performer may review tentative treatment plan:

i) The approximate volume to be irradiated, including the dimensions and depth of the tumor and the desired margin surrounding the tumor to be irradiated for safety.

ii) The tentative minimum tumor dose needed to effect the curative or palliative objective for the type of tumor involved.

iii) The maximum dose to be allowed to normal tissue (maximum allowable portal or given dose, set by the institution or modified to reflect proximity of tumor to radiosensitive tissues).

iv) The energy level (kilovoltage or megavoltage), where appropriate.

v) The dose-time relationships: number of treatments and frequency of visits for administration of total dose (fractionation).

f. Performer notes whether sufficient information is available to plan for pre-treatment set up procedures. May note whether selection of treatment machine seems inappropriate. Informs proper co-worker or radiotherapist, or obtains needed information as appropriate.

2. Performer notes what pre-treatment procedures are required for treatment planning and set up based on the type and location of tumor, type of proposed field arrangement and proposed treatment machine.

a. Performer notes what must be done before simulation or set up takes place:

i) Notes whether additional localization films will be required before set up to identify location of tumor, its size,

TASK DESCRIPTION SHEET (continued)

Task Code No. 561

This is page 3 of 4 for this task.

List Elements Fully

depth, location of organs to be protected, and/or to measure thickness of tissue. Notes whether localization films will be AP or PA and lateral diagnostic films, transverse tomography films, or computerized transverse axial tomography (CTT) scans. Notes specific orders on centering, area of interest and/or level.

ii) Notes whether a cast, mold, or shell must be constructed for immobilization of patient and to ensure accurate treatment of the volume to be irradiated.

iii) Notes whether a contour must be constructed or drawn to facilitate dose calculations and/or set up. Notes orders on location at which contour is to be constructed.

iv) Notes whether a physics plan will be required and which verification films will be needed.

b. Performer notes whether the machine and field arrangement to be used will require simulation (on a simulator machine which produces diagnostic quality radiographs while duplicating the geometry of the treatment machine with the patient in the treatment position,) or will be done in the appropriate treatment room (where the treatment machine is used to take beam films).

i) Considers whether the patient must be confined to stretcher and the amount of time anticipated to be needed.

ii) Notes appropriate target-to-skin distance (TSD), or source-to-skin distance (SSD), or source-to-tumor distance (STD), or source-to-axis (isocenter) distance (SAD).

List Elements Fully

iii) Notes whether isocenter technique is required for set-up, and the availability of such equipment for simulation.

c. Considers whether there is the need to have any contrast medium introduced to obtain localization films of radiosensitive organs and/or tumor, or probes inserted to visualize the extent of body cavities. Notes which procedures are ordered and equipment needed.

3. Performer notes what type of beam limiting and/or modifying devices are required based on type of equipment and location of tumor.

a. Notes whether a bolus, wax mold, and/or wedge filter(s) may be needed to provide for differential attenuation of the beam in cases of eccentric tumors, or to restore the effect of a flat surface when the treatment surface is not flat.

b. Notes whether filters are to be added to the beam column to affect beam quality.

c. Depending on type of equipment, notes whether shielding, blocks, or applicators (cones) will be used to limit the beam, whether beam directing devices such as pin and arc, back pointer, side light system will be needed.

d. Notes whether and when physicist or other staff member must be consulted on field separation requirements.

4. Performer notes special considerations to be taken into account based on the patient's condition:

a. Notes whether female patient is or may be pregnant, whether fetus pro-

TASK DESCRIPTION SHEET (continued)

Task Code No. 561

This is page 4 of 4 for this task.

List Elements Fully

tection must be ensured. Notes any additional protective shielding that may be appropriate.

b. Notes whether patient, such as pediatric patient, may require prior sedation, special immobilization equipment. Notes whether patient is ambulatory, will be in a wheelchair or on a stretcher.

c. Considers whether the age and condition of the patient and the type of tumor require special nursing services. Notes whether dressings will have to be removed, surface cleansed, and dressings replaced. Considers the extent to which the patient may be moved or is obstructed by casts, infirmity, or IV apparatus.

d. Considers whether special notation of the patient's psychological state must be made to ensure proper attention to the patient.

e. Considers whether the patient requires the services of an interpreter.

5. Performer considers the sequence of procedures necessary for coordinated treatment planning, such as production of casts or shells, and/or contour before simulation, the need for localization films before physics plan, etc. Performer lays out a tentative schedule for the events.

a. Takes account of time required for various procedures, the personnel required, and the need to have radiotherapist or physicist available to approve materials, contours and/or films produced.

b. Arranges to schedule procedures as appropriate. Makes sure proper staff are requested for nursing functions and/or for administration of contrast or insertion of probes for localization.

List Elements Fully

c. As appropriate, assigns patient to simulator or treatment machine for simulation and/or initial set-up based on machine capabilities, the availability of the equipment, and the needs of the proposed technique.

d. Makes sure that instructions are clear on the localization films needed, and the verification (portal) films to be made (simulator or beam films) to check set-up.

6. Performer writes out and may orally communicate instructions for scheduling of patient; includes information on the proposed treatment technique, the localization and/or simulation room, the need for special procedures, services, or personnel, and any other relevant information.

a. Gives information and materials to appropriate co-worker, or sets aside for own use, as appropriate.

b. If appropriate, expedites scheduling for emergency patient.

c. May inform or report to appropriate staff member when initial scheduling has been planned.

TASK DESCRIPTION SHEET

Task Code No. 562

This is page 1 of 4 for this task.

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Proposed treatment plan evaluated in terms of knowledge of capacities of proposed external beam radiotherapy equipment; auxiliary equipment, dose calculations checked; information on discrepancies volunteered; questions on machine capacities answered or checked.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Patient's medical and/or therapy chart or relevant medical information, radiographs and/or beam films; proposed treatment plan; paper, pen or pencil; prepared charts and information on capacities of external beam radiotherapy equipment and auxiliary devices; view boxes

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Radiotherapist; physicist; any co-worker involved in treatment planning for external beam radiotherapy

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Participating in discussion on, or answering questions about, external beam radiation therapy equipment in relation to proposed treatment plan, by reviewing diagnostic information, proposed plan; evaluating, checking or answering questions about output capacities, field sizes, beam characteristics, about beam shaping, blocking, attenuation devices, about availability of special techniques; checking calculations; suggesting modifications; noting other discrepancies in plan and machine capabilities; volunteering information and/or responding to questions.

List Elements Fully

Performer provides information based on experience with external beam radiation therapy equipment during formal or impromptu conferences or discussions on the feasibility of a proposed new treatment plan or the revision of a treatment plan for a patient receiving radiation therapy, or answers questions about equipment, or checks aspects of such plans when called on.

1. If participating in a conference or a discussion, performer may note, review, or ask about the clinical background to the proposed treatment plan with respect to the following information:
    a. Notes patient's name, sex, height, weight and age. Notes whether proposed treatment plan is for new patient or a revision of an ongoing treatment plan.
    b. Notes whether performer has personal knowledge of the patient and the current treatment plan.
    c. Reviews appropriate diagnostic films (and current localization and/or treatment films if ongoing treatment) and clinical information indicating the nature of the tumor, its estimated location, size, and volume.
        1) Notes whether the tumor is in close proximity to healthy, radiosensitive tissues.

OK-RP; RR;RR

6. Check here if this is a master sheet..(X)

TASK DESCRIPTION SHEET (continued)

Task Code No. 562

This is page 2 of 4 for this task.

List Elements Fully

ii) Notes whether the treatment is for curative or palliative purposes, whether the disease is considered terminal, and whether the therapy is to be done in conjunction with other modalities such as surgery, interstitial, intracavitary radiation, and/or chemotherapy. Notes history of previous radiation treatments.

iii) May review radiographs and/or beam films of tumor.

iv) Notes information (if any) on progress of treatment if a revised plan is involved.

2. Performer determines what aspects of the proposed treatment plan are being considered and what aspects of the plan the performer is being asked to evaluate and/or check.

3. Performer may note any or all of the following aspects of the proposed treatment plan:

   a. Notes the machine selected for the type of tumor, such as a superficial x-ray machine, orthovoltage or conventional x-ray machine; megavoltage (supervoltage) equipment, such as betatron or linear accelerator (and choice of x-ray or electron beam), or teletherapy machine using radioactive isotopes as gamma ray source, such as cobalt-60 or cesium-137, depending on the equipment available.
   b. May note the approximate volume to be irradiated, including the dimensions and depth of the tumor and the desired safety margin surrounding the tumor to be irradiated.
   c. Notes the recommended field locations and arrangements for the treatment (whether stationary, such as single direct field(s), parallel opposed pair(s), moving strip fields, wedge-pair, multiple converging fields; or moving fields, such as arc or rotation), and the need for devices to direct or affect beam quality or shape and/or special shielding.
   d. Notes the appropriate distance from the source or target to the center of the field (TSD or SSD), or to the tumor (TTD or STD), or to an isocenter axis (TAD or SAD).
   e. Notes tentative minimum tumor dose needed to effect the curative or palliative objective for the type of tumor involved.
   f. Notes maximum dose to be allowed to normal tissue (maximum allowable portal or given dose, set by the institution or modified to reflect proximity of tumor to radiosensitive tissues).
   g. Notes energy level (kilovoltage or megavoltage), where appropriate.
   h. Notes dose-time relationships: number of treatments, frequency of treatments for each field, and frequency of visits for administration of total dose (fractionation).
   i. Notes whether a cast, mold or shell will be used for immobilization of patient.
   j. Performer notes what type of beam limiting and/or modifying devices are to be used, based on type of equipment and location of tumor:

      i) Notes whether a bolus, wax mold, and/or wedge filter(s) will be used to provide for differential attenuation of the beam in cases of eccentric tumors, or to restore the effect of a flat surface when the treatment surface is not flat.
      ii) Notes whether filters are to be added to the beam column to affect beam quality.

TASK DESCRIPTION SHEET (continued)

Task Code No. 562

This is page 3 of 4 for this task.

List Elements Fully

iii) Depending on type of equipment, notes whether shielding, blocks, or applicators (cones) will be used to limit the beam, whether beam directing devices such as pin and arc, back pointer, or side light system will be needed.

k. Notes what special protection is planned to protect a fetus if patient is pregnant, to protect radiosensative healthy tissue, gonads.
l. Notes whether patient, such as pediatric patient, may require prior sedation, special immobilization equipment. Notes whether patient is ambulatory, will be in a wheelchair or on a stretcher.

4. Performer may volunteer information on the feasibility of the plan based on own knowledge of the equipment available and experience, or consider questions placed directly by radiotherapist, physicist or co-worker.

5. If performer is asked about the output capacities of any external beam equipment with which the performer is familiar, performer responds, as appropriate, about any of the following in relation to the equipment:

   a. The minimum and maximum kilovoltage or megavoltage produced.
   b. The maximum and/or minimum field size obtainable with the equipment.
   c. The devices available to affect the quality, homogeneity and/or penumbra of the beam.
   d. The devices available to affect the shape or size of the beam and/or to provide shielding.
   e. The size wedges available (if appropriate) to effect differential beam attenuation.
   f. The type of exposure control (timer or dosemeter).

List Elements Fully

   g. Whether the proposed machine provides capabilities such as use of isocenter technique for set-up, provides for arc and/or rotation field arrangements and/or through-couch exposure.
   h. Performer responds based on knowledge of the equipment, and/or consults available information on the equipment.

6. Performer may consider or check whether the machine selected can deliver the plan outlined in the proposed treatment plan and/or whether the tumor dose planned will provide an unacceptable given dose which exceeds safe limits.

   a. May make calculations based on appropriate depth dose formulas and prepared charts, such as percentage depth dose and output charts.
   b. If the capacities of the machine in terms of beam quality or quantity, or of field size, or the depth dose relationships are inappropriate to the needs of the proposed plan, performer indicates this. May suggest alternative equipment or attachments.
   c. If the proposed treatment plan calls for use of wedge filter(s) performer may check the estimated width of the treatment field and note whether the equipment selected and the standard size wedges available can accommodate the plan. If not, performer may indicate this. Performer may suggest an alternative.

7. Performer may also contribute opinions on any or all of the following:

   a. Whether treatment times, frequency of treatments to fields are prac-

TASK DESCRIPTION SHEET (continued)

Task Code No. 562

This is page 4 of 4 for this task.

List Elements Fully	List Elements Fully
tical for the patient and the machine. b. Whether there are structural impediments to achieving the plan at the prescribed angles, such as restrictions on the movement of the equipment or on the patient's mobility. c. Whether the treatment field sizes have been properly designated in relation to the particular isodose line corresponding to the edges of the light field of the particular machine. d. Whether there has been adequate planning to account for junction points between fields and field separation.	

TASK DESCRIPTION SHEET

Task Code No. 563

This is page 1 of 25 for this task.

1. **What is the output of this task?** (Be sure this is broad enough to be repeatable.)

Simulation and/or initial set-up for proposed treatment plan carried out;localization,verification portal films made,approved;treatment fields and areas to be shielded or blocked laid out and marked on patient,cut out of cast,mold,shell;blocking diagram, lead cut-outs, bolus,contour made;field dimensions recorded;wedge filters checked;patient reassured, given explanation,instructions;records entered for use.

2. **What is used in performing this task?**

Pt.'s proposed treatment plan,requisition sheet, ID card,bracelet,medical-technical chart,prior radiographs,scans;view boxes;simulator or treatment machine,controls,TV monitor,intercom,fluoroscope;distance,beam angle indicators;table;light system;collimator;beam accessory holder;blocking tray;cones,applicators,periscope;scales,rulers;x-ray film,holders, cassettes;cassette holder;wax markers;immobilization devices;stent;eye shields;lead shielding;radiopaque cross,markers,strips,ID markers;beam blocks;cast,or mold,shell,mask;beam direction device,pin and arc, back pointer,side lights;wire,plastic plate,metal grid;tape,scissors;dye,ink,sticks;wedge filters;tissue compensator,rod device;bolus;contour;cardboard; pen,pencil;pt. instructions;stretcher,wheelchair; barium mixture;procedure tray;support stand;transparent film;level;forms;soap,water;calipers

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. **If "Yes" to q. 3:** Name the **kind** of recipient, respondent or co-worker involved.

Any radiotherapy patient;radiotherapist;co-worker; physicist;family member;nurse

5. **Name the task** so that the answers to questions 1-4 are reflected. Underline essential words.

Carrying out simulation and/or initial set-up for any patient to receive external beam radiation therapy of the head,neck,and/or spinal column using simulator or treatment machine by reviewing proposed treatment plan;preparing equipment;reassuring,explaining procedure to pt.;positioning,immobilizing pt.for treatment using proposed geometry;laying out direct,oblique,parallel opposed,wedge,and/or wedge-pair treatment fields;laying out shielding or blocking for tissues to be spared;taking localization, verification portal films until all field lay-outs are approved;preparing for shell,shield to be cut out, bolus or tissue compensator,contour to be made;making beam block diagram;marking field lay-outs,triangulation points on patient or shell;recording field dimensions,wedge filter dimensions;explaining self care,after-effects,danger signs to pt.;disassembling approved set-up;recording.

List Elements Fully

Performer carries out simulation and/or initial set-up procedures for any patient scheduled to receive external beam radiation therapy of the head and/or neck, and/or for medulloblastoma.

1. Depending on institutional procedures,performer receives or obtains the simulation and/or initial treatment set-up requisition form, the patient's identification card, the proposed treatment technique, related medical information, diagnostic and/or localization radiographs or scans (such as ultrasonograms, radioisotope scans, computerized transverse axial tomographic (C.T.T.) scans).

2. Performer reads the requisition sheet to determine what type of set-up is called for, the patient involved, his or her condition, the area to be treated, the purpose, the equipment involved, any special considerations, and to check the completeness of the information provided. Plans ahead for procedure:

   a. Notes the patient involved, the condition, and the area to be treated (treatment volume).

      i) Notes the patient's name, identification number, sex, height, weight and age.

      ii) Notes the name of the radiotherapist in charge.

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK DESCRIPTION SHEET (continued)

Task Code No. 563

This is page 2 of 25 for this task.

List Elements Fully

iii) Notes whether patient is in-patient, out-patient, to be treated as emergency patient.

iv) Notes the nature and location of the tumor and the treatment volume for which the simulation and/or set-up is to be done.

v) For organ such as the eye, notes whether there is to be unilateral or bilateral radiation; if unilateral, notes side of interest. Notes whether a contralateral eye has been enucleated.

vi) May note information on volume to be irradiated, including the dimensions and depth of the tumor and the desired safety margin surrounding the tumor to be irradiated.

b. Performer notes whether the simulation and/or initial set-up is for a new treatment plan, for a change in the treatment volume in an ongoing treatment program, for evaluation of the clinical course of treatment, recheck of treatment area after a review of treatment verification films (taken during treatment), or to precisely localize and/or document organs to be protected,junction points between portals.

c. Notes whether the proposed treatment technique is for radical (curative) or palliative purposes, whether the therapy is to be done in conjunction with other modalities such as surgery, interstitial or intracavitary radiation, and/or chemotherapy. Notes whether radiation therapy is pre-operative, post-operative. Notes history of previous radiation treatment.

d. Performer notes whether simulation is called for to localize the treatment volume, organs or tissues to be shielded and to verify the portals (treatment fields), or whether only initial set-up is required (such as

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for superficial lesions).

i) If simulation is required, notes whether scheduling is for simulation on a simulation machine (which uses an x-ray tube to produce diagnostic quality radiographs while duplicating the geometry of the treatment machine with the patient in the treatment position), or whether the treatment machine will be used to take beam films.

ii) Notes whether calculation of radiation dose distribution and of daily treatment doses and/or time will follow simulation.

e. Notes the machine selected for treatment technique, such as gamma ray megavoltage source (such as cobalt-60), electron beam source (such as linear accelerator), superficial x-ray beam source (such as Grenz rays), orthovoltage x-ray beam source, or a combination for various fields.

f. Notes whether an intraoral cone, periscope applicator, and/or submental pressure cone will be needed.

g. Performer notes the recommended field locations and arrangements for the treatment,such as stationary direct field(s), parallel opposed portals, single wedge fields, wedge pairs, combinations of fields, or field within a field.

i) Notes whether a single field including spinal cord and brain will be used, cranial field(s) with two unequal-length spinal fields,or a combination of these, such as for medulloblastoma.

ii) Checks the suggested position of the patient for each treatment field, such as supine, lying on side, prone, or erect in chair provided with head support.

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h. Performer notes any special considerations that may affect the positioning or handling of the patient.

- i) Checks whether emergency patient will undergo treatment immediately after the simulation and initial set-up is approved.
- ii) Checks whether patient mobility is restricted and will interfere with the planned positioning of patient. If so, may plan for alternative positioning or may report and/or suggest alternative positioning to the physician in charge.
- iii) Checks whether patient is suffering from a collateral condition requiring special attention in handling, such as heart disease, communicable or infectious condition, infirmity, incoherence, behavioral disorder.
- iv) Checks whether patient such as epileptic must be treated on a ground level stretcher to protect patient from accident. If so, plans simulation and/or initial set-up to duplicate treatment situation.
- v) Notes whether patient will have IV drip, oxygen supply, urinary catheter, colostomy, T-tube, or similar device attached, interferring with the patient's mobility.
- vi) Notes whether patient will be arriving on stretcher, wheelchair, will be accompanied by nurse, other staff, parent or guardian.
- vii) Depending on institutional procedures, performer may note whether female patient is pregnant, reviews date of female patient's last menstrual period, or notes any other indication that there is no danger of exposure of a known or possible fetus. If female patient is or may be pregnant, notes what fetus protection must be ensured. Notes any additional protective shielding that may be appropriate.
- viii) Notes whether patient, such as pediatric patient, may require prior sedation, special immobilization equipment.
- ix) Considers whether the age and condition of the patient and the type of tumor require special nursing services. Notes whether dressings will have to be removed, surfaces cleansed, and/or dressings replaced.
- x) Considers whether the patient's psychological state must be considered to ensure proper attention to the patient.
- xi) Considers whether the patient requires the services of an interpreter.

i. Performer may note and check on any prior preparation and/or concurrent procedures ordered for patient as listed in chart or requisition sheet:

- i) Performer may note whether orders for prior nursing preparations have been given and carried out; if not already done, may arrange to have orders carried out or informs appropriate staff member.
- ii) If patient's record indicates orders for sedation or any other prior medication, performer may check timing to be sure a proper elapse of time has occurred for medication to take effect. May arrange to delay procedure if appropriate.
- iii) May note pediatric patient's feeding schedule and arrange to have patient fed while in department if not contrary to needs of procedure.

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iv) If lab tests, dental consultation, clinical care have been ordered to be done prior to simulation and/or initial set-up, performer checks that these have been carried out and that results are with patient's chart.

v) If treatment of the eye is involved, notes whether local anesthetic is to be administered prior to procedure or once patient is in procedure room. Notes whether a localization contact lens will be fitted into place.

vi) Notes whether a staff member is required to introduce intraoral stent, approve placement of wedge filters.

vii) Notes whether a contour must be constructed or drawn to facilitate dose calculations and/or set-up. Notes orders on location at which contour is to be constructed and at which point in procedure it is required.

viii) Notes whether radiotherapist in charge and/or medical or health physicist will be available to approve set-up, verification portal films, to carry out special procedures, approve contour, etc.

ix) Notes names of staff members assigned to simulation. If appropriate, checks that any staff needed for interpreting, nursing or other services are present.

x) Checks whether consent form is signed and present. If not, performer arranges to have patient or guardian talk with radiotherapist.

j. Performer checks that any information, materials or equipment ordered are ready for use in the simulation or initial set-up procedure:

i) Notes whether a lead, plastic or plaster shell, mask, or cast has been ordered (to provide shielding to surrounding tissue, accurate and reproducible field localization, to immobilize patient and/or to provide a seating for the beam applicator or cone).

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ii) Notes whether an intraoral stent has been ordered to protect the tongue and other tissues and/or provide a seating for an intraoral cone or applicator.

iii) Notes whether a tissue equivalent bolus has been ordered (to compensate for a rounded contour with superficial or orthovoltage or to bring the 100 percent depth dose to the surface with megavoltage equipment).

iv) Checks that any shell, mask, cast, stent and/or bolus ordered has been delivered and meets the listed specifications.

v) Notes whether localization films and/or scans have been ordered to assist in outlining the portals and to define the areas to be protected from radiation. Checks that this was done or arranges to have localization films or scans made, processed and returned.

vi) Notes whether localization during the procedure will include fluoroscopy (if legal for performer) and/or radiography.

vii) If patient is to undergo a change in treatment plan, makes sure that earlier localization and verification portal films are present.

viii) Notes whether a physics plan has been ordered and prepared to determine the treatment field arrangement, junction points and field separation, and the blocking necessary to protect normal tissues.

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k. Performer reviews the requisition for simulation and/or initial set-up to be sure he or she understands what is required and that all the needed information is present:

i) With regard to the field arrangements, notes the number of fields, the locations, the specified size of each, the orientation of each field, any non-regular shapes or angulation required.
ii) Notes what methods will be used to define the edges of the field, such as use of light system, markers, cross method, cut-outs of mold, cast, mask or shell, anatomical landmarks, visible superficial lesions.
iii) If the light system is to be used to outline the entrance portals, checks that the isodose level (percentage dose) at the edge of the light field for the given machine at the designated source-to-skin distance (SSD) and field size is the one used in standard treatment planning (i.e., that the machine characteristics correspond to the plan).
iv) For each field, notes the desired margin of normal tissue to be included in the treatment volume (in cm's) for safety.
v) Checks orders for separation between fields.
vi) For wedge field arrangements, notes the wedge angle(s) selected, the orientation of the field(s), the "hinge angle" between fields, the length and width of each field.
vii) Notes the appropriate type of applicator for the given modality, such as open ended applicator attached to cut-out field in shell, mask, or cast, intraoral or submental cone seated in mold or intraoral stent.

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viii) Performer checks the required distance from the source or target to the center of the field (TSD or SSD). For fields that are irregular or not flat, notes where the nominal SSD will be measured, such as at center of field, at the shortest SSD in the treatment field, or as designated.
ix) Notes what materials will be used to limit the beam to the area of interest, such as lead beam blocks suspended in tray holder over patient, treatment shell or mold with cut-out for field, direct use of shielding, use of applicator or cones, depending on the equipment and the location of the tumor.
x) Notes what positioning and immobilization devices will be used, such as shell or mold, head support, intraoral stent, intraorbital applicator with built-in shielding, whether back pointer, side lights will be used.
xi) Notes the normal tissues to be protected from radiation exposure such as spinal cord, larynx, trachea, esophagus, cornea, eye. Notes whether localization films are needed to design appropriate shielding.
xii) Notes special shielding ordered for sensitive tissue such as lead shielding, eye shielding, strips of shielding to be applied to nasal septum, mouthpiece to be placed behind the mucosal surface of the lips to shield teeth and the alveolus. Notes whether head holder, masking tape, sand bags, mouth bite block, or cork will be used to immobilize and/or keep tongue or jaw out of the radiation beam.

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i) Plans all exposures with the treatment or simulator source or target centered as for treatment, at the prescribed SSD, and at 90° to the horizontal or vertical plane unless otherwise specified.

ii) May plan a radiographic, fluoroscopic (if legal) or beam film exposure to establish the general area of interest, including the treatment field, and to visualize any organs to be protected or radiopaque markers (such as shielded lens or nasal septum, an esophagus visible because of contrast material).

iii) May plan the first and/or second exposure to verify proposed outline of the treatment field and a second or third exposure with beam limiting or shaping devices and/or shielding in place.

iv) If using the treatment machine for beam films, plans to make the first exposure to include an area surrounding the field, and a second exposure on the same film, collimated to the field outline. May plan a second film with beam blocks in place.

v) If using the cross technique with megavoltage equipment, may plan to use a metal cross on the tray suspended from the beam column to mark the center of the field on the film and on the patient. Plans to use the processed film to block in the field boundaries.

3. When performer is clear about what will be involved in the simulation and/or initial set-up, he or she prepares ahead so as not to keep the patient in the simulator or treatment room longer than necessary:

a. If performer is not already assigned to a simulator room or a particular treatment room for the procedure, notes the machine and room assigned. Goes to the room assigned.

b. Makes sure that, if a simulator or diagnostic equipment is to be used for localization and/or verification films, the equipment can be set for the exact source-to-skin distance (SSD) prescribed for the treatment machine.

c. If using a treatment machine with a diagnostic type x-ray tube for localization or verification films, makes sure that the alignment of the diagnostic beam with the treatment beam has been checked, or has this done.

d. If using a light system for outlining the treatment field, makes sure that the alignment of the light beam with the radiation beam has been checked, or has this done.

e. Washes hands as appropriate.

f. Performer checks that the proper materials are present:

i) Checks for appropriate set-up accessories for positioning, immobilizing patient, blocking or filtering beam, providing shielding, making patient markings.

ii) Checks for materials needed to make contour if appropriate.

iii) Checks that procedure tray is equipped as appropriate, based on set-up, patient's condition and requisition.

iv) Checks for clean linens on table, pads, supports to make patient comfortable.

v) Makes sure that right (R) and left (L) markers are available for use and identification cards, leaded numerals or markers.

vi) Prepares for identification of the localization or verification films as appropriate. Checks identification against requisition sheet.

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vii) Checks that appropriate size cones, extenders, filters are present, depending on the equipment involved and the field sizes to be set up.

viii) Makes sure that an adequate supply of loaded cassettes of the appropriate types and sizes for the field arrangements and localization films are available in the room.

ix) May check that any internal eye shields are smooth, that surfaces will not cause corneal abrasion, and that shield is sterilized.

x) If anything is missing, arranges to obtain or decides to obtain personally.

g. Performer makes sure that equipment is ready for use:

i) For gamma ray equipment, makes sure that the source is in a "safe" position and that the time switch is on "off" position.

ii) For x-ray equipment checks that machine is "warmed up."

iii) With equipment where there is a diagnostic radiography or fluorroscopic mode selector, sets as appropriate. Sets collimator controls for manual operation.

iv) Checks that appropriate attachments arc in place on the unit head, such as collimator holder, beta ionization chamber (for electron beam mode), tray for beam blocks with megavoltage equipment.

v) If appropriate, obtains tray to hold lead blocks and attaches to accessory ring on unit head at prescribed height. May attach appropriate size collimator (for use with electron beam mode) to collimator holder in unit head.

vi) If appropriate for the equipment, performer may adjust a centimeter scale for the prescribed SSD and insert it into the beam column to be used for the simulation and/or initial set-up.

vii) If fluoroscopic equipment will be used for localization, sets up as appropriate. May connect TV monitor, set up for automatic density control. May move image intensifier into position; may check that controls and timer are operative as appropriate.

viii) May check that remote control system is operative, as appropriate.

h. Performer reviews the appropriate technical factors to be used for diagnostic-type films, or the time or radiation exposure to set with gamma ray source to provide verification beam films. May refer to technique chart for the equipment.

i. Checks whether a filter has been prescribed to produce a homogeneous beam quality. Checks that appropriate type for the kVp to be used is available. May insert in unit head above cone holder. When using filter of more than one metal, e.g., copper and aluminum, performer may make sure that filter is inserted with aluminum side nearest the table and facing away from the target.

j. Performer obtains film in cassette or holder of type appropriate for the equipment, and size appropriate for the first field to be laid out. Attaches identification information as appropriate and places in position, such as under the table in bucky, cassette tray or tunnel, in slot in head rest, or in vertical holder.

4. Performer readies the patient for the simulation and/or initial treatment set-up:

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a. Performer washes hands as appropriate. Depending on patient's condition and the materials involved, carries out appropriate antiseptic and aseptic techniques.

b. Performer has the patient brought from the holding area and prepared for the procedure (if not already done), or decides to do personally. Depending on institutional arrangements, performer may decide to assist in bringing patient to the simulation or treatment room.

c. Performer greets patient and any accompanying staff person and/or parent or guardian, and introduces self. Checks patient's identity against the requisition sheet. With in-patient, checks hospital identification bracelet or other identifier. Checks with any accompanying staff member on any special precautions necessary during procedure.

d. Performer makes patient comfortable on the simulation table, couch, chair, or as appropriate to the type of treatment planned.

  i) If appropriate, moves treatment table and has patient on stretcher moved into treatment table location (at ground level if required for safety of patient, such as epileptic).
  ii) If patient is in wheelchair, may move patient in chair into position next to table. Makes sure that wheelchair is in locked position.
  iii) Performer may decide to assist patient to table or has this done. May obtain help. Makes sure that no equipment is in the way that may be collided with by patient. If assisting patient to step on footstool in order to get on table, helps patient turn into position, step backwards on stool, and then sit and/or lie on table. May raise or lower table.
  iv) May have nurse carefully place young patient on table, or lifts patient carefully and places on table.
  v) If patient has a life support system in place, such as respiration, cardiac or infusion equipment, makes sure that this is being monitored.
  vi) If there is a wet dressing, performer has it reinforced or decides to do personally.
  vii) Makes sure patient is being attended and there is no danger patient will fall off table.

e. Performer carefully explains to patient and/or family member the purpose of the simulation and/or setup procedures and what to expect. Uses language appropriate to patient's level of comprehension.

  i) Explains to patient and/or family member what steps will be carried out, what positions patient will be in, what immobilization devices will be used, what cooperation will be asked of patient.
  ii) Notes that radiation therapy patients may be concerned or frightened about the procedures involved. May explain the radiotherapy process.
  iii) Explains that the external radiation will not make the patient become radioactive, that patient will not be a hazard to anyone.
  iv) Explains that the radiation for filming and/or treatment produces no sensation.
  v) Explains the need for immobilization devices.
  vi) Explains why patient will be in separate room for treatment, how patient remains under observation, and shows how patient can

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communicate with performer during filming and/or treatment. May practice using inter-communication system.

vii) Explains equipment in layman's terms if patient is concerned about the massive appearance of the equipment.

viii) Explains how patient can help by remaining perfectly still during the filming and treatment.

ix) If an adult family member is to be allowed to be present with patient during any part of the procedure, makes sure that such a person understands that he or she cannot be present during actual therapy.

x) If appropriate and not already done, performer questions female patient of child bearing age regarding possible pregnancy. If there is any possibility that patient is pregnant, and this has not already been recorded, performer informs radiotherapist in charge at once; proceeds only with approval.

f. If not already done, performer has patient undressed as for treatment and draped with sheet, if appropriate.

i) If not already done, has patient remove dentures, hair pins, spectacles, and any jewelry from head and neck.

ii) May tie patient's hair or wrap so that hair is kept away from treatment area. May have patient use hair net.

iii) May swaddle child or have this done.

g. Performer attempts to establish a supportive relationship with the patient while preparing for the procedures. If necessary may converse through interpreter.

i) Performer exercises care in reassuring patient while treating patient with dignity and compassion, bearing in mind that patient is suffering from a malignant disease that may be terminal, or with uncertain or poor prognosis. Without being blandly optimistic, performer tries to put patient at ease.

ii) Considers the patient's psychological state, noting that the diagnosis may have been recent. Notes that patient may be frightened, emotionally disturbed, subject to behavioral disorders, may be incoherent, depressed, withdrawn, bitter or hostile. Performer attempts to exercise consideration, respect, understanding, and as much warmth as possible.Treats patient with dignity and concern regardless of patient's behavior.

iii) Performer is careful to be supportive of the patient with respect to the patient's self-concept, body image and acceptance of the situation that there is a disease condition to be treated or palliated.

iv) If the performer will be the staff member to regularly administer the treatment, performer attempts to develop a trusting relationship of mutual respect. Makes note of the patient's general appearance, behavior and emotional affect in order to be aware of any marked changes in the patient over the course of treatment.

v) If performer notes any unusual behavior or physical indication, or if patient is in an unusually

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agitated state or in great pain, performer may notify radiotherapist without alarming patient.

- vi) If sedative, analgesic or other medication is prescribed, performer proceeds as appropriate, allowing time for medication to take effect.
- vii) Performer answers patient's or family member's non-medical questions honestly; attempts to reassure patient and develop confidence. If performer notes that a patient or patient's family is misinformed about the treatment objectives, such as whether treatment is for palliation or cure, performer brings this to the attention of the radiotherapist in charge so that the physician can clarify the purpose of the treatment to the patient or family persons involved.
- viii) If questioned about medical prognosis, performer refers patient to his or her attending radiotherapist and indicates that refusal is result of ethical considerations rather than unwillingness to deal with patient. Performer does not lie or invent information.
- ix) Performer discusses the patient's case only with the radiotherapist in charge, unless required in order to carry out the procedure.

h. Performer may check whether a photograph has been taken of the patient for identification purposes.

- i) Notes whether photograph of the area to be treated is required for record of pre-treatment appearance.
- ii) Notes whether photograph is required of the treatment set-up and field arrangement.

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- iii) May plan to take photograph personally or have this done at appropriate time.

i. At appropriate point in procedure performer may have special immobilization or shielding procedures carried out by appropriate staff member, or carries out personally if qualified:

- i) May request that staff member such as radiotherapist mark anatomical localization points if appropriate, center of field, or upper or lower edge of field.
- ii) May have physician anesthetize patient's eye(s), or may apply anesthetic eye drops personally.
- iii) May have shielding inserted over anesthetized eyeball. May have upper lid retracted. May apply eye cup shielding.
- iv) May have contact lens with lead markers inserted into eye.
- v) For a nasal portal, such as for lesions at or above the equator on the nasal aspect of the retina, performer may request that radiotherapist adjust tip of beam directing applicator by fitting into socket of enucleated eye, and angle it to avoid the lens of the contralateral eye.
- vi) May have shielding inserted into nostrils to protect the nasal septum or does personally.
- vii) May have radiotherapist insert intraoral stent, tongue block, or other protection device as appropriate. May have tongue and lower jaw positioned with mouth bite block, or cork and tongue blade.
- viii) May have contrast mixture to be taken orally (such as barium paste or liquid) prepared. Administers to patient at proper time or has this done.

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5. If patient has a visible, superficial lesion to be treated, with no organs to be localized for shielding, performer may plan to lay out the treatment field(s) directly without portal films as ordered by the radiotherapist. May plan to photograph treatment set-up.

6. Performer sets up the patient for the first treatment field area to be localized, depending on the proposed treatment technique, the type of equipment to be used, and the size and position of the field:

   a. If a shell, mask, cast, or mold has been prepared for patient, may place this in position on table or chair, or fits directly on patient; lines up as appropriate with anatomical marks.

      i) For two-part shell, may position lower part of shell, adjust patient, and then place and secure upper portion.
      ii) If the portal has not been cut out of the device, performer plans to have this done after laying out treatment field.

   b. Plans, assists, or has patient assume the appropriate position for the first treatment field, such as lying supine on table for anterior or lateral portals, prone (with head fixed over end of treatment couch for a single cerebrospinal field) for posterior fields, seated for submental or intraoral portals, or lying on side with head supported in lateral position (for some head and/or neck portals).

      i) If the proposed treatment plan calls for a single field with the treatment area at a depth below the surface, positions the patient for localization and treatment set up for the given field.

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      ii) If the proposed treatment plan calls for a pair of direct parallel opposed fields (two symmetrically placed fields opposite one another, e.g., two lateral fields or anterior and posterior), chooses the anterior or posterior or lateral field which is to be the first one localized, and positions patient accordingly.
      iii) If the proposed treatment plan calls for a pair of parallel opposed fields with the beams entering at an oblique angle, chooses the first oblique field and continues as with a single field with obliquely incident angle of entry.
      iv) If the proposed treatment plan calls for an obliquely incident beam, performer positions patient as ordered or studies the diagnostic or localization films provided to estimate the location and size of the tumor, the angle of entry, and the field location required to include the tumor in the effective beam and avoid sensitive tissues. Chooses a field with the shortest possible skin-to-tumor distance that also avoids sensitive organs and tissues.
      v) If the proposed treatment plan calls for a stationary multiple converging field arrangement (arrangement of three or more treatment fields, all converging on the tumor), studies the proposed field arrangement. Notes whether these are to be treated as symmetrical sets of direct parallel opposed fields (i.e., opposite one another from the point of view of beam entry and exit) and/or fields in which the incident beams enter obliquely

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at an angle to one another, or any combination of these. Chooses the first field for localization and positions patient accordingly. Chooses a direct field before doing any that require an oblique angle of entry.

vi) For split beam technique, (use of half the collimated area as treatment portal), centers so that the cross-hair marker of the light system falls on the appropriate perimeter of the intended field, so that the treatment field will be obtained when half the collimated light area is blocked.

vii) For intraoral treatment field, sets up periscope applicator as appropriate or asks radiotherapist to apply. May attach applicator to cone holder in unit head and attach distal end to the seating in the intraoral stent already inserted; may ask to have this done by radiotherapist.

viii) For submental field or for other field which requires a pressure cone or extension cone that will be applied directly to the patient's skin and create the appropriate portal at the SSD prescribed, obtains cone of appropriate size and length and inserts in cone holder in unit head. May add cone extender. Moves unit head using controls so that end of cone (open or closed as appropriate) is in direct contact with the treatment field or is directly engaged in the seating provided in the patient's shell, mold, or mask.

ix) If patient has been undergoing external beam therapy and is present to have treatment field changed or verified, performer notes any markings of the fields being treated as reference points.

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x) Is careful not to dislodge any support apparatus such as IV.

xi) May align and center patient using midline markers on table.

xii) If appropriate, turns on sidelights (lights at exactly the same level on either side of room creating a single horizontal light beam at a given height).

xiii) Adjusts shell, mask or mold as appropriate so that the device will always be in same position on table. Checks that patient is comfortable but unable to move the area to be treated. May mark mask or shell and/or patient's skin so that set-up can be replicated exactly.

c. For cerebrospinal or spinal field such as for medulloblastoma, performer attaches a shielding block or lead shield above patient on treatment table with window cut out to expose the treatment field.

i) Depending on orders, may define a single posterior cerebrospinal or spinal field; may divide the posterior spinal field into two contiguous fields for even-day treatment and two different contiguous fields for odd-day treatment (to avoid junctional dose inhomogeneity).

ii) May position patient so that the cerebral part of a single field is encompassed in the width of the opening in the beam blocks or cut-out opening in the shield.

d. Performer applies any appropriate immobilization devices to patient to keep patient in a constant position which is comfortable enough to maintain and appropriate for the tumor type, location, and the

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equipment to be used.

i) May use weighted bags, foam rubber pads, head clamp, straps, tape or other devices as prescribed or as deemed necessary.
ii) May ask patient about how comfortable the position is and adjust if possible.
iii) May reassure child who is frightened by the immobilization procedures. May place a bright object to be used to attract a young child's attention to fix the patient's gaze.
iv) May direct patient to turn eye to one side or another to avoid the path of the beam.
v) After patient has been immobilized, performer makes sure that patient is still able to make small movements necessary for normal circulation, respiration and other vital functions.

e. Unless the SSD for the treatment field has been obtained by use of applicator, cone, or intraoral periscope device in contact with the field, performer adjusts the simulator or treatment machine to the SSD prescribed for the treatment field being set up.

i) May use optical distance meter and collimator light system with cross-hair shadow as reference for center of useful beam. May use centimeter scale set in beam column placed in direct contact with patient's skin.
ii) Activates the light system. May dim room lights.
iii) Adjusts the collimator opening to include an area somewhat larger than the anticipated field size. Includes all areas of interest

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such as extensions of surgical scar.
iv) Uses the cross-hair shadow as reference for center of field and centers to any marks or anatomical reference points. With megavoltage treatment machine, may center metal cross on tray suspended from the unit head, or may insert calibrated grid or mesh screen on tray; uses shadow cast by the cross or grid as reference. Selects grid appropriate for the SSD to be used.
v) For a direct field adjusts beam column to zero degrees.
vi) For an obliquely incident beam field, adjusts unit head to the prescribed angle or uses collimator light to estimate the field and adjusts beam angulation until the light cast covers the area of interest. Centers to estimated entry point. Records beam angulation obtained by reading indicator in beam column.
vii) Using center reference point, cross-hair shadows, distance indicator, or the distance at which the centimeter scale touches the skin (or cast, shell, mold or mask which will be cut out to create treatment field), performer adjusts height of beam column and/or table height to the prescribed SSD.
viii) For field surfaces that are not flat, performer measures SSD as prescribed, such as from center of field, at shortest possible SSD, or at a level half the distance of the spread from the shortest and longest possible SSD in the treatment field.
ix) In the case of casts, molds, shells or masks, allows for the thickness of the materials if

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these will be cut away to create the treatment field.

x) For medulloblastoma posterior field, raises the beam column and/or lowers table so that an SSD is obtained suitable to include the entire length of the longest posterior field. May adjust beam angulation to a cephalad angle as ordered to avoid irradiation of the eyes.

f. Performer may check or determine the angulation, entry and/or exit portal positioning of oblique field(s) using backpointer or pin and arc.

i) If both the entry and exit points are accessible and have been marked, performer may attach back pointer to accessory ring of beam column and adjust unit head until the tip of the back pointer coincides with the marked position of exit of the central ray. Records the angle obtained.

ii) If beam directing is needed, if the beam column does not have an angle scale, and if only the entry mark is available, may attach pin and arc device to accessory ring of beam column. Adjusts so that the desired SSD is achieved with the beam column centered on the tumor. Records the resulting readings for the pin, arc and rod settings and the angle of entry of the central beam.

7. Performer may take localization films of the first portal area before outlining the field. If so, may proceed as follows:

a. If appropriate, performer may measure the patient in order to select exposure factors. May use centimeter

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calipers to measure the thickness of the area to be radiographed in the direction in which the central ray of the x-ray beam (or treatment beam) will pass through the centered part from tube to film. Records for use in determining exposure factors.

b. Performer selects the exposure factors for the first projection by consulting the technique chart(s) posted for the machine to be used.

i) For diagnostic x-ray tube, locates the information needed for the body part and projection involved according to the centimeter thickness of the part as measured and the collimated field size to be used. Makes sure that technique relates to the combination of film type and speed and SSD to be used. Makes note of the kVp, mA, seconds of exposure time for the overhead exposure or fluoroscopy.

ii) For gamma ray (beam film) exposure, notes whether equipment uses a timer or a dosimeter for exposure control. Notes the time or rad exposure to use to make localization film of the area.

c. Performer sets the technical factors selected in the control room.

i) Makes sure machine is ready for use and set to the appropriate mode.

ii) For diagnostic x-ray tube sets technical factors (kVp, mA, time) or as appropriate for automatic exposure timing.

iii) For fluoroscopy sets up and adjusts TV monitor. Sets factors as appropriate for conventional viewing or automatic brightness

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control, depending on whether kVp or mA is automatically controlled.

iv) For beam film sets time or rad exposure as appropriate.

d. If not already done, performer sets up so that the center of the field will be recorded on the film or be visible on the TV monitor.

i) May check that metal cross or grid is in position on accessory tray.

ii) May place radiopaque marker on patient's field surface (skin or mold, cast, or shell to be cut out) where the cross-hair shadow indicates the center of the field.

iii) If exit point is relevant and can be determined with back pointer, pin and arc, or other device, may place radiopaque marker at center of exit portal.

iv) If not already done, performer centers film (in holder or cassette) to the central beam. For right angle beam angulation, centers film to the center of the area of interest and central beam. For obliquely incident beam, centers film to include the entry and exit portals.

v) If appropriate, makes sure that right or left marker and other identification information will be exposed or recorded on film.

vi) Performer may place a metal centimeter scale as appropriate at the level of the treatment field to be radiographed and used for calculations. May place in the midline of the field.

vii) When everything is ready for the exposure, performer explains what will happen and the importance of holding still during exposure. May have patient practice holding still when requested until told to relax. If appropriate, instructs patient not to swallow during exposure.

viii) Makes sure everyone leaves the room. Explains to patient that performer and other staff are nearby in control room and that patient is under observation.

ix) May have radiotherapist called to view fluoroscopic image if appropriate.

e. Performer returns to control room to make exposure.

i) Makes sure controls are properly set and patient is still in position.

ii) Tells patient when to hold still by calling or using intercom.

iii) Initiates exposure by using the appropriate exposure control, or activates fluoroscope control(if legal) and observes on TV monitor, or assists radiotherapist.

iv) Makes sure exposure is terminated as appropriate.

v) After exposure is completed, tells patient that he or she can relax.

f. Unless fluoroscopy was used to localize the treatment area, or if the film will be kept in place for a second exposure of blocked out field area, performer removes the exposed cassette or film holder. Has film processed at once or decides to do personally.

8. Performer uses fluoroscope image or processed radiograph and light system to establish the first field outline:

a. With fluoroscopy (while exposure is under way), performer notes comments from radiotherapist or own observations to adjust the field

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to include or exclude organs or tissues from the useful beam. Between exposures may move radiopaque marker as directed or decide personally to mark center of field.

b. With beam film, if film is to be left in place, performer proceeds to outline the first field using light system, collimator and beam blocks according to specifications.

c. With processed radiograph, performer examines processed film.

   i) Checks that the areas of interest are visible, that the appropriate features such as radiopaque markers, scale, organs have been localized.

   ii) Repeats filming if radiograph is inadequate, noting reason for problem to avoid future "retakes".

   iii) Performer may bring the processed radiograph to radiotherapist, or displays on light light box as appropriate. Receives instructions on the exact location and dimensions of the portal or assists the radiotherapist while he or she draws in the outline of the portal on the radiograph.

   iv) Performer may readjust centering, beam angulation, SSD or immobilization of patient based on radiotherapist's orders.

d. If the field is outlined on the radiograph and the cross method is to be used, performer places the radiograph with the field outlined on the patient's field surface.

   i) Uses the light system and adjusts the film so that the shadow of the cross cast by the light beam coincides with the image of the cross on the radiograph.

   ii) May center with reference to image of radiopaque marker and cross-hair shadow.

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e. Performer collimates to the exact field size specified so that the light cast from the collimator exactly coincides with the field drawn on the radiograph or specified in relation to the center marker and anatomical reference points on the patient.

   i) If the field is irregularly shaped or if the field will be defined with beam blocks as well as collimator, performer may position beam blocks on tray or on platform above patient so that the light cast exactly fits the field as drawn or specified. Makes sure that beam block tray is at prescribed height.

   ii) For split beam technique, performer sets the collimator to twice the length of the prescribed field size so that the cross-hairs of the light beam are on the border of the field when blocked. Then attaches beam block to appropriate half of light area.

f. When ready to outline field on patient, performer removes the radiograph from the patient's treatment surface.

g. If the field outline is to be verified, performer outlines the perimeter of the light field on the patient's body (or on the surface of cast, mold or shell where cut-outs will be made). Uses radiopaque strips to define the perimeter of the field. Maintains the SSD, beam angulation and centering, and immobilization of patient.

   i) If performer does not have to verify the field dimensions by making exposure, or if beam will enter obliquely, performer outlines the illuminated field

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using vegetable dye. Applies with a stick.

ii) When the field has been outlined by the radiopaque strips, performer may open collimator so that the areas included and those excluded from the field can be visualized on portal film.

iii) With a double-exposure beam film, maintains collimation and blocking so that the second exposure indicates the treatment field (superimposed on first exposure).

9. Performer makes the verification film of the first portal as appropriate:

   a. Unless beam film is still in place, places an identified cassette or film in holder in cassette holder or tunnel and centers as described above. May prepare for fluoroscopy and call radiotherapist as described.
   b. Sets or resets technical factors as appropriate, as described above.
   c. Clears room; has patient hold still; makes exposure or activates fluoroscope and views on TV monitor as described above.
   d. Considers the adequacy of the field lay-out.

      i) With fluoroscopy, performer may assist while radiotherapist views image on TV monitor; may view personally. Adjusts radiopaque strips between exposures as directed or decided.
      ii) With verification portal films, has radiograph processed as described above, and views processed radiograph; then places for viewing by radiotherapist.
      iii) Performer may first personally consider whether the strips and/or angle of beam column have been properly chosen to include all of the treatment volume without unnecessary exposure of healthy tissue.

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      iv) If performer decides that the strips and/or the angle of the beam column must be readjusted, does so, and repeats steps described above until performer is satisfied that the field has been properly defined and outlined. Where vegetable dye rather than radiopaque strips have been used, removes unwanted markings with soap and water.

   e. During review by radiotherapist performer notes any orders for changes in field dimensions, centering, beam angulation, or blocking.

      i) Performer adjusts the field dimensions and shape as ordered by moving the strips, adjusting block and/or collimator, and/or beam angulation as ordered.
      ii) May take additional films or carry out fluoroscopy as described above until the portal dimensions are approved.
      iii) Performer is careful not to make more exposures than are absolutely necessary to have accurate portal and record.

10. If a wedge filter or wedge pair treatment fields have been prescribed, performer may proceed as follows:

   a. Notes the wedge size prescribed for the first field, its angle, the orientation of the thicket end of the wedge, and the angle of incidence to the field.
   b. Measures the dimensions of the first wedge field as laid out and approved. Records.

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c. Performer checks whether the wedge filter size available for the machine will accomodate the needs of the patient's field width as measured. If not, reports this to radiotherapist and follows alternative procedure as ordered.

d. Selects wedge filter according to size prescribed from wedge selector and inserts in accessory ring.

   i) For wedge pair makes sure that heel of wedge is properly placed in relation to second field (at appropriate "hinge angle").

   ii) May check that a pinpoint of light at the thin end of wedge filter is visible on the field and that no strip of light is visible from the beam column on the patient's body.

   iii) If no pinpoint of light is visible, performer reports that wedge size is too large; if strip of light is visible, performer may recommend a larger size for wedge filter.

   iv) Performer follows alternative procedure as ordered and repeats check if appropriate.

11. At appropriate point during procedure, performer applies triangulation marks to ensure duplication of the set-up position.

   a. With patient and equipment in the approved treatment position, records the center of the field, and/or the center of the exit portal. Marks with appropriate dye on patient and/or as appropriate on cast, mold, or shell.

   b. Uses side lights to mark a point on either side of the patient at right angles to the plane of interest.

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12. If a tissue compensator must be prepared for an irregularly contoured field or to raise the 100 percent dose level to the skin surface, depending on the equipment, performer may proceed as follows:

   a. If a bolus of tissue equivalent material has been prescribed for the patient involved, performer may arrange for its preparation if not already done.

   b. If the bolus is to be molded on patient, to be used with orthovoltage equipment (to be placed between the skin and the applicator to make the shape of the isodose curve for the field predictable), performer has patient wheeled to the work area where such devices are prepared or does so personally.

   c. May use a device such as a matrix column of rods attached to machine, with machine in the treatment position. Brings each rod into contact with the patient's field surface so that the air gap can be measured and a bolus prepared. Locks rods into position and removes device. Sends to have bolus prepared.

   d. May have the appropriate staff member given the proper information on the field size, location, and proposed treatment plan, so that the bolus can be molded directly on the surface area involved. Arranges to have patient and prepared bolus returned to room when ready.

   e. When the bolus or tissue compensator is prepared, performer makes sure that it has been properly identified with respect to the patient for whom it was prepared. Checks that positioning directions are included. Places on patient's

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skin and checks that bolus is appropriate size and shape.

13. When the portal dimensions have been approved, performer notes whether additional areas are to be blocked out or shielded from the central ray, such as the homolateral eye, spinal cord, trachea, larynx, esophagus, lacrimal gland. May proceed as follows:

    a. Performer may mark out areas to be shielded on the approved portal film using marker.

        i) Refers to instructions, image of areas made radiopaque with the use of contrast medium, or devices such as radiopaque contact lens, anatomical reference points, or marks.
        ii) May have radiotherapist draw in areas to be blocked or shielded.
        iii) May judge areas to be shielded or blocked by referring to patient markings, by palpating, or by referring to localization films.

    b. Performer notes whether shielding cut-outs will be made and placed directly on the patient's field surface, whether the field area to be exposed will be cut out of a lead mask, whether beam blocks will be placed in tray attached to accessory ring in beam column, or whether areas to be blocked will be outlined with wire so that blocks of prescribed HVL can be fabricated, depending on the type of equipment to be used.
    c. Performer may place loaded cassette or film holder in position as described earlier.

        i) Centers the marked-out portal film on the surface of the patient or on the surface of the cast or shell to be cut out. Uses the light system and projected image of the cross or the cross-hair shadow to line up the center of portal film with beam column.
        ii) Checks that tray is at proper height.
        iii) May place beam blocks of the prescribed HVL on tray in arrangement to coincide with field dimensions and to block area to be protected from radiation as drawn on radiograph on patient's field surface. May insert beam blocks between the two layers of the tray, insert into holder, clamp into position. Checks that the shadows cast by the blocks correspond with the areas to be shielded.
        iv) If blocks are to be fabricated, performer may lay out areas to be blocked by placing lead wires on a grid placed in the blocking tray so that their shadow, cast by the light beam, corresponds with the outline on the radiograph or as marked on the patient's body.
        v) If lead shield cut-outs are to be used, obtains lead cut-outs of the prescribed HVL, or has cut-outs prepared by tracing areas to be shielded from portal film. Places lead shield cut-outs on patient's skin; refers to anatomical reference points, markings, and/or uses centimeter scale to determine exact locations.

    d. When the performer determines that the areas to be shielded are all outlined or shadowed by beam blocks or shielding, performer repeats the filming of the portal as de-

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scribed earlier. Has radiograph processed.

i) Takes the processed portal film to the radiotherapist for approval.
ii) Makes any corrections in layout as ordered and repeats as appropriate until the field layout has been approved.
iii) Performer has radiotherapist indicate approval of final portal set-up as appropriate, such as with signature on film.
iv) May arrange to have photograph taken of final set-up if appropriate, or decides to do personally.

14. Performer makes record of the field outline and blocking set-up so that it can be duplicated for treatment:

a. If beam blocks or lead cut-outs were used, performer traces the approved outlines on the patient's skin using dye or ink. Follows outline of the cut-outs or the shadows cast by the beam blocks on the tray or the outline of the wires laid out on the tray.
b. If beam blocks were used, performer may make a record of the prescribed HVL and the arrangement on the beam block tray (beam block diagram):

i) May use the grid on the tray to record location of the beam blocks. Removes blocks.
ii) Performer may insert a plain plastic plate into a slot in the beam block tray. Draws outline of approved field dimensions and areas within field to be blocked using wax pencil. Places tip of pencil on the plate so that its shadow falls on the patient. Follows the markings on the patient's field surface so that

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the pencil duplicates on the plate the markings laid out on patient.
iii) Performer may remove the plate and tape lead wire onto the plate, covering the wax markings made of the field arrangement to duplicate the field lay-out. Performer then replaces the plate in the tray. Opens collimator beyond field borders. Checks that the image of the wires lines up with the field markings on the patient. Adjusts as appropriate.

c. If the portal is to be cut out of a cast, mask, or shell, performer indicates the dimensions of the window to be cut by drawing in lines connecting the radiopaque strips, including areas to be shielded.

i) Performer may indicate that a hole already cut needs to be enlarged. Draws in enlargement lines or measures and records the enlargement needed.
ii) Performer removes the cast, mold, or shell and has the window cut out according to the dimensions indicated.
iii) When the shell, cast, or mold is returned, performer repeats the set-up using the light system, and checks that the appropriate portal has been created.
iv) May repeat filming of portal to make sure that the cut-out provides an accurate field for exposure and shielding.

d. If the portal is to be cut out of a lead mask, and if the performer has already drawn in the treatment field on the patient's skin, may lay transparent film, cello-

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phane, or other material over the portal and trace it, using appropriate marker. Also traces center marker and any other centering or anatomical marks. Identifies pattern; has it transferred to the lead mask. Checks accuracy of cut-out as described above (for cast or shell).

e. At appropriate point during procedure, performer may have a contour prepared, duplicating the patient's body surfaces at the level of the tumor. May request that this be done by co-worker such as physicist, or decides, if appropriate, to do personally.

f. With a complex field arrangement, such as with wedge pair fields, may prepare a cardboard cut-out, using the contour already prepared:

  i) May use a pocket level fastened to the cut-out to line up cut-out with a predetermined horizontal line.

  ii) Transfers to the cardboard (set at right angles to the patient's field) the location of lines indicating edges of the field, SSD, anatomical landmarks, beam angulation, center marks. Records and places cut-out with other set-up materials.

g. If not already done, performer outlines the exposure field on the patient's skin using ink or dye.

  i) Makes sure to mark field outline, center of field, entry and exit points, side light marks, areas for blocking or shielding.

  ii) If appropriate, if skin marks may fade, or if permanent marks are needed, performer may assist while radiotherapist tattoos marks for the center and/or corners of the field using hypodermic needle and ink.

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h. Measures the field marked on the patient's body with centimeter ruler (flexible ruler for rounded field surfaces). Records measurements on appropriate form.

i. Unless the radiopaque strips for the first field will be used for locating other fields, performer removes strips.

15. Throughout the procedure, performer observes the patient for any signs of emergency and/or to prevent or respond to an accident. Is alert to signs of nausea, dizziness, or sweat, suggesting faintness. Notifies nurse or radiotherapist at once. If patient shows any emergency signs, loses consciousness, or has an accident, performer calls appropriate physician or nurse at once. May decide to provide emergency first aid as well.

16. If only one treatment field is required, performer proceeds to terminate as described below.

17. If a second treatment field is to be set up and verified, performer may proceed as follows:

  a. If the proposed treatment plan calls for a pair of parallel opposed fields (either direct or with beam at an oblique angle of incidence), removes the immobilization devices from the patient.

    1) If the opposed fields are lateral fields and permit the use of side lights for set up, performer uses measurements or markings already made to find the center of the first field. Performer adjusts the table position so that one of the beams of light is cast on the center mark. Performer then

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marks the place where the opposite light beam strikes the reverse side; marks and treats as center of field. May repeat with other field boundary points.

ii) If the opposed fields are anterior-posterior, performer has the patient turn over. Assists patient if appropriate, or has co-worker assist. Performer realigns the patient so as to reproduce the reverse of the same field (the posterior view if anterior view has just been localized).

iii) If the opposed fields are arranged at an oblique angle of incidence, performer uses beam directing devices and/or side lights as described above; refers to tumor and center markings on the patient.

iv) Repeats all the appropriate steps already described for the first field, but uses all the measurements obtained for the first field in order to reproduce them directly for the second field.

b. For multiple converging fields, notes whether the second field is a parallel opposed field in relation to the field first set up. If so, arranges the second field, as described above, either as a direct field or an oblique field, depending on the proposed field arrangement. If a second field is required, with beam direct or oblique, performer treats as in the steps described above for the first field arrangement, and as appropriate for a direct or obliquely incident beam.

c. For wedge-pair fields, performer notes or is told the estimated dimensions, the location of the second field, and the angle prescribed between the two fields.

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i) For the second field performer adjusts the beam column to the required angle of incidence to achieve the prescribed "hinge angle" between the fields, as ordered. Records the angle as read on the beam column angle scale.

ii) Adjusts beam column to the prescribed SSD as described, making measurement from the designated area of the field.

iii) Collimates to the field area indicated. Outlines field, and records measurements as described above.

iv) Checks second wedge filter as described above. Makes sure to insert second filter so that the heel of the two wedge filters will lie towards each other.

d. Performer follows instructions on the separation between fields. Measures distances between the first field outlined and the second field as indicated by the light system, using centimeter scale.

e. Performer checks to make sure that no fields overlap to avoid "hot spots" (overlap of areas of high irradiation in other than volume of interest).

i) Leaves strip markers in place for any direct fields laid out.

ii) Tries to avoid hot spots due to overlap of fields at exit portals by using fluoroscopy and/or portal films to note whether the lead outlines of direct fields overlap with exit portals of non-parallel fields on the opposite side of the patient. If performer judges that there is exit portal overlap of

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the fields, repeats field layout and localization procedures as appropriate until there is no such overlap, or reports to radiotherapist.

f. Performer measures and records the oblique angle of incidence for each field to be entered obliquely.
g. Measures and records the distances between each field, using a flexible centimeter scale.
h. Performer repeats localization of portal area, outlining of field with radiopaque strips and/or dye, planning of shielding or beam blocking, preparation of cut-outs, tissue compensators, as described earlier.

    i) If ordered, performer repeats any or all steps to adjust the localization and field set-ups until they are approved by radiotherapist.
    ii) Washes off discarded field outlines with soap and water.
    iii) Records final field dimensions, beam column angles, and/or wedge filter sizes when approved.

18. Performer continues as described for any third or more fields to be set up and verified.

19. If performer has any questions or has encountered any problems with the setup, such as structural impediments to achieving the plan at the prescribed angles, restrictions on the movement of the equipment or on the patient's mobility, discusses with radiotherapist if not already done and continues as ordered.

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20. Performer checks that all records are complete and that custom-made devices are accounted for:

a. Performer makes sure that the final verification portal films are identified with patient identification information and with indications of the views involved. May include patient's name and number, physician's name, date, type of film, machine number.
b. Records all the relevant information such as field sizes, separations, beam angulation, SSD.
c. Assembles the patient's chart, films, simulation sheet, any special equipment such as a bolus, immobilization devices, cast, cut-outs, contours, cardboard cut-out. Arranges to have these given or sent to the appropriate co-worker.
d. If not already done, may have photograph(s) taken of the field set-up(s).
e. When the radiotherapist indicates that all procedures have been completed, carefully removes any immobilization devices from patient and replaces in appropriate locations.

    iii) May have an eye pad applied to an eye that has been anesthetized. Indicates how long it should be worn to protect patient until eye reflexes return.
    ii) Removes localization devices, stents, beam directing devices, shell or mask as appropriate.
    iii) Has any devices to be used again by the patient identified.
    iv) Has intraoral devices placed for sterilization if appropriate.
    v) Moves the beam column out of the way.

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f. Performer may make sure that all the measurements and information needed to calculate the daily given dose and tumor dose are properly recorded on the appropriate form(s).

g. After or if the treatment plan is approved, may check that a copy is placed in the folder to be used by the radiation therapy technologist.

21. Performer may discuss with patient what has been done in order to make clear what procedures the patient must follow in order to be properly treated. If appropriate, talks through interpreter, and/or talks with adult accompanying pediatric patient:

a. Performer explains the importance of retaining the body markings which outline the field area(s). Depending on the material used, indicates whether washing is prohibited.

b. Performer explains any prohibitions on use of cosmetics or toiletries on field area, if appropriate.

c. Performer explains any preparatory procedures before treatment as appropriate.

d. If institutional policy, performer may answer questions about or inform patient about side effects that can be expected with the treatment, such as skin reactions, nausea, fever, loss of appetite.

e. Encourages patient to report skin reactions, changes in eating habits, fluid intake and output, bowel movements, any nausea or pain to the radiotherapist or nurse so that these can be noted and help provided.

f. May arrange to have a check list prepared and given to patient or family member to reinforce the instructions.

22. Performer notes whether patient is to be scheduled next for special localization procedures, such as tomography, transverse axial tomography, or computerized transverse axial tomography, so that dose calculations can be made. Notes whether patient is to go directly to treatment, back to room, or to any other scheduled location.

a. If appropriate, makes sure that designated staff person is there to bring patient to appropriate next location.

b. May decide to assist patient to leave; may decide to transport personally; or may have this done.

c. May indicate to appropriate staff person when the performer is ready to proceed with next simulation and/or initial set-up.

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1. **What is the output of this task?** (Be sure this is broad enough to be repeatable.)

Simulation and initial set-up for proposed treatment plan carried out; localization, verification portal films made, approved; treatment fields and areas to be blocked laid out and marked on patient, cut out of shell; blocking diagram, contour made; field dimensions recorded; wedge filters checked; patient reassured, given explanation, instructions; records entered for use.

2. **What is used in performing this task?**

Pt.'s proposed treatment plan, requisition sheet, ID card, bracelet, medical-technical chart, prior radiographs, scans; view boxes; simulator or treatment machine, controls, TV monitor, intercom, fluoroscope; distance, beam angle indicators; table; light system; collimator; beam accessory holder; blocking tray; extension cones; scales, rulers; x-ray film, holders, cassettes; cassette holder; wax markers; immobilization devices; lead shielding; radiopaque cross, metal grid, markers, strips, ID markers; beam blocks; shell; beam direction device, pin and arc, back pointer, side lights; wire, plastic plate; tape, scissors; dye, ink, sticks; wedge filters; contour; pen, pencil, pt. instructions; stretcher, wheelchair; barium mixture; procedure tray; forms; soap; water; strip field collimators

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. **If "Yes" to q. 3:** Name the **kind** of recipient, respondent or co-worker involved, with descriptions to indicate the relevant conditions; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Any radiotherapy patient; radiotherapist; co-worker; physicist; family member; nurse

5. **Name the task** so that the answers to questions 1-4 are reflected. Underline essential words.

Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the thorax, such as lungs, pleura, esophagus, mediastinum, using simulator or treatment machine by reviewing proposed treatment plan; preparing equipment; reassuring, preparing, explaining procedure to pt.; positioning, immobilizing pt. for treatment using proposed geometry; laying out direct, oblique, parallel opposed, wedge, isocentric, arc or rotation, or moving strip treatment fields; taking localization, verification portal films; calculating STD; obtaining approval for set-up; having contour made; preparing beam blocking diagram; marking field lay-outs, triangulation points on pt.; recording field dimensions, geometry, wedge filter dimensions; explaining self care, after-effects, danger signs to pt.; disassembling approved set-up; recording.

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Performer carries out simulation and initial set-up procedures for any patient scheduled to receive external beam radiation therapy of the thorax, such as for tumors of the lung, pleura, esophagus, mediastinum.

1. Depending on institutional procedures, performer receives or obtains the simulation and initial treatment set-up requisition form, the patient's identification card, the proposed treatment technique, related medical information, diagnostic and/or localization radiographs or scans (such as ultrasonograms, radioisotope scans, computerized transverse axial tomographic (C.T.T.) scans).

2. Performer reads the requisition sheet to determine what type of set-up is called for, the patient involved, his or her condition, the area to be treated, the purpose, the equipment involved, any special considerations, and to check the completeness of the information provided. Plans ahead for procedure:

   a. Notes the patient involved, the condition, and the area to be treated (treatment volume).

      1) Notes the patient's name, identification number, sex, height, weight and age.

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

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ii) Notes the name of the radiotherapist in charge.

iii) Notes whether patient is in-patient, out-patient, to be treated as emergency patient (such as for superior vena cava syndrome).

iv) Notes the nature and location of the tumor and the treatment volume for which the simulation and set-up are to be done.

v) May note information on volume to be irradiated, including the dimensions and depth of the tumor and the desired safety margin surrounding the tumor to be irradiated.

b. Performer notes whether the simulation and initial set-up are for a new treatment volume in an ongoing treatment program, for evaluation of the clinical course of treatment, for a recheck of the treatment area after a review of treatment verification films (taken during treatment).

c. Notes whether the proposed treatment technique is for radical (curative) or palliative purposes, whether the therapy is to be done in conjunction with other modalities such as surgery, interstitial or intracavitary radiation, and/or chemotherapy. Notes whether radiation therapy is pre-operative, post-operative. Notes history of previous radiation treatments.

d. Performer notes whether simulation is to be done on a simulator machine (which uses an x-ray tube to produce diagnostic quality radiographs while duplicating the geometry of the treatment machine, with the patient in the treatment position), or whether the treatment machine will be used to take beam films.

i) Notes whether localization radiographs will be required during or after the set-up for calculation of the radiation dose distribution and/or daily treatment dosage and time.

ii) Notes the machine selected for treatment technique, such as supervoltage teletherapy with cobalt-60, supervoltage electron beam or x-ray therapy with linear accelerator or betatron.

e. Performer notes the recommended field locations and arrangements for the treatment, such as direct stationary fields (parallel opposed, multiple converging, obliquely incident, moving strip fields), obliquely incident fields, wedge fields, or moving fields with arc or rotation. For stationary fields notes whether the isocenter technique available for moving fields will be used for set-up procedures.

f. Performer notes any special considerations that may affect the positioning or handling of the patient.

i) Checks whether emergency patient will undergo treatment immediately after the simulation and initial set-up is approved.

ii) Checks whether patient mobility is restricted and will interfere with the planned positioning of patient. If so, may plan for alternative positioning or may report and/or suggest alternative positioning to the physician in charge.

iii) Checks whether patient is suffering from a collateral condition requiring special attention in handling, such as heart disease, communicable or infections condition, infirmity, incoherence.

iv) Checks whether patient must be treated on a stretcher. If so, plans simulation and initial

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set-up to duplicate treatment situation.

- v) Notes whether patient will have IV drip, oxygen supply, urinary catheter, colostomy, T-tube, or similar device attached, interferring with the patient's mobility.
- vi) Notes whether patient will be arriving on stretcher, wheelchair, will be accompanied by nurse or other staff.
- vii) Depending on institutional procedures, performer may note whether female patient is pregnant, reviews date of female patient's last menstrual period, or notes any other indication that there is no danger of exposure of a known or possible fetus. If female patient is or may be pregnant, notes what fetus protection must be ensured. Notes any additional protective shielding that may be appropriate.
- viii) Notes whether patient may require prior sedation, special immobiliation equipment.
- ix) Considers whether the condition of the patient and the type of tumor require special nursing services. Notes whether dressings will have to be removed, surfaces cleansed, and/or dressings replaced.
- x) Considers whether the patient's psychological state must be considered to ensure proper attention to patient.
- xi) Considers whether the patient requires the services of an interpreter.

g. Performer may note and check on any prior preparation and/or concurrent procedures ordered for patient as listed in chart or requisition sheet:

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- i) Performer may note whether orders for prior nursing preparations have been given and carried out; if not already done, may arrange to have orders carried out or informs appropriate staff member.
- ii) If patient's record indicates orders for sedation or any other prior medication, performer may check timing to be sure a proper elapse of time has occured for medication to take effect. May arrange to delay procedure if appropriate.
- iii) If prior clinical care, such as treatment for infection, anemia, therapeutic diet, and subsequent evaluation of the patient's general condition has been ordered, if lab tests have been ordered prior to simulation, performer checks that these have been carried out and that results are with patient's chart.
- iv) Notes whether procedures to visualize the esophagus are ordered, such as barium swallow, insertion of a plastic tube in esophagus (with lead beads or BB shots spaced inside the tube). Notes procedure, materials needed, and staff person assigned to insert the tube.
- v) Notes whether a staff person is required to approve placement of wedge filters, to construct or draw a contour. Notes orders on location at which contour is to be constructed and at which point in procedure it is required.
- vi) Notes whether the radiotherapist in charge and/or a medical or health physicist will be available to approve set-up, verification portal films, to carry out special procedures, approve contour, etc.

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vii) Notes names of staff members assigned to participate in simulation. If appropriate, checks that any staff needed for interpreting, nursing or other services are present.

viii) Checks whether consent form is signed and present. If not, performer arranges to have patient or guardian talk with radiotherapist.

h. Performer checks that any information, materials or equipment ordered are ready for use in the simulation and set-up procedures:

i) Notes whether an immobilization shell or esophagus board has been prescribed to help maintain patient in position. If so, notes whether the item is present and ready for use.

ii) Notes whether localization films and/or scans have been ordered to assist in outlining the portals and to define the areas to be protected from radiation. Checks that this was done or arranges to have localization films or scans made, processed and delivered to the procedure room.

iii) Notes whether localization during the procedure will include fluoroscopy (if legal for performer) and/or radiography.

iv) If patient is to undergo a change in treatment plan, makes sure that earlier localization and verification portal films are present.

v) Notes whether a physics plan has been ordered and prepared to determine the treatment field arrangement, junction points and field separation, and the blocking necessary to protect normal tissues.

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i. Performer notes detailed orders on treatment field set-ups:

i) Notes what methods will be used to define the edges of the field, such as use of light system, radiopaque markers, cross method, anatomical landmarks.

ii) If the light system is to be used to outline the entrance portals, checks that the isodose level (percentage dose) at the edge of the light field for the given machine at the designated source-to-skin distance (SSD) and field size is the one used in standard treatment planning (i.e., that the machine characteristics correspond to the plan).

iii) Notes the location of each field, approximate dimensions, and adjacent radiosensitive tissue to be protected, such as spinal cord, lungs.

iv) For each field, notes the desired margin of normal tissue to be included in the treatment volume (in cm's) for safety. Checks orders for separation between fields.

v) Checks the suggested position of the patient for each treatment field, such as supine, seated erect, or prone.

vi) Notes whether an esophagus board will be used to aid with positioning patient in prone position or whether, for posterior field(s), patient will be treated through the couch.

vii) Performer checks the required distance from the source or target to the center of the field (TSD or SSD), or to the tumor (TTD or STD). May note whether STD and source-to-isocenter axis (SAD) are to be calculated from localization films during simulation.

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viii) For fields that are irregular or not flat, notes where the SSD will be measured, such as at center of field, at the shortest SSD in the treatment field, at anatomical points such as spinal cord, at mid or upper mediastinum.

ix) For arc or rotation, notes location of the direct field for set-up, the prescribed degree(s) of rotation, and the initial direction for arc.

x) For wedge field arrangements, notes the wedge angle(s) selected, the orientation of the field(s), the "hinge angle" between fields, the length and width of each field.

xi) For moving strip technique, notes the size of each strip, the probable number of strips and the orientation of the arrangement, i.e., whether the field strips are to be drawn vertically or horizontally on the patient's body, how the strips are to be numbered.

xii) Notes the tissues to be protected from radiation exposure with beam angulation, blocking, skip-scan technique or added filtration, such as a contralateral lung, spinal cord. Notes the appropriate shielding to be provided to the gonads or to a fetus.

xiii) Notes the portal filming required and at what point approval is required.

xiv) Notes any anatomical landmarks to be marked on the patient's skin to be used for positioning, defining or locating the fields, field center, corners, the entry point for the central beam, the perimeters of fields, areas to be blocked. Notes whether any markings will have been made by radiotherapist, will be made by radiotherapist during simulation, or will be made by performer.

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j. Performer examines the diagnostic radiographs, scans, localization and any verification films on view boxes. May examine C.T.T. scans or ultrasonograms.

i) Familiarizes self with the location, size and depth of the tumor to be treated and any organs to be protected.

ii) Notes any topographic indicators to be used as guidelines in setting up treatment field(s).

iii) May refer to image of centimeter scale or use scale to estimate dimensions.

k. Performer makes sure that the request is properly authorized, and that the information needed is complete.

i) If the performer determines that the request is not properly authorized, is incomplete, or that sufficient information is lacking for performer to carry out the simulation and the initial set-up for the treatment, performer notifies supervisor, radiotherapist, physicist, or other designated staff person, depending on institutional procedures.

ii) If performer has any questions about the proposed treatment technique, discusses with appropriate staff person such as radiotherapist.

iii) Proceeds after obtaining needed information, signature, or orders.

3. Performer may plan initial localization or grid film(s), a film for a field verification, and final verification portal films. May plan to have lateral or tomographic films made (to

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determine tumor depth) if not already done; may decide to do so personally.

a. For conventional fixed field simulation, plans all exposures with the treatment or simulator source or target centered as for treatment, at the prescribed SSD and at 90° to the horizontal plane unless otherwise specified.

b. For simulation with a gantry-mounted unit for isocenter technique (to set up multiple stationary fields) or for arc or rotation set-up, plans to set up for the prescribed source-to-tumor distance (STD) so that the STD will equal the source-to-axis distance (SAD).

   i) May plan to make right-angle AP and lateral projections to measure the STD if so ordered.

   ii) May plan to refer to a provisional reference point (R) which approximates the tumor center. Notes anatomical reference points and centering points marked by radiotherapist on the patient on the frontal plane and on either side so that table can be centered in two axes with isocenter point at R. May have points marked during procedure.

   iii) If preliminary localization and treatment planning have already been done, performer may note corrections from R to the true tumor center (T). May plan to continue with set-up, marking the actual treatment isocenter points on patient.

c. If using the treatment machine for beam films, plans to make the first exposure to include an area surrounding the field and the second exposure on the same film, collimated to the field outline. May plan a second film with beam blocks in place.

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d. If using the cross or grid technique with megavoltage equipment, may plan to use a metal cross on the tray suspended from the beam column or the center marker on the grid to mark the center of the field on the film as on the patient. Plans to use the processed film to block in the field boundaries.

4. When the performer is clear about what will be involved in the simulation and initial set-up, he or she prepares ahead so as not to keep the patient in the simulator or treatment room longer than necessary:

   a. If performer is not already assigned to a simulator room or a particular treatment room for the procedure, notes the machine and room assigned. Goes to the room assigned.

   b. Performer makes sure that, if a simulator or diagnostic equipment is to be used for localization and/or verification films, the equipment can be set for the exact SSD or SAD prescribed for the treatment machine.

   c. If using a treatment machine with a diagnostic type x-ray tube for localization or verification films, makes sure that the alignment of the diagnostic beam with the treatment beam has been checked, or has this done.

   d. If using a light system for outlining the treatment field, makes sure that the alignment of the light beam with the radiation beam has been checked, or has this done.

   e. Washes hands as appropriate.

   f. Performer makes sure that equipment is ready for use:

      i) For gamma ray equipment, makes sure that the source is in a

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"safe" position and that the time switch is in "off" position.

- ii) For x-ray equipment checks that machine is "warmed up."
- iii) With equipment where there is a diagnostic radiography or fluoroscopic mode selector, sets as appropriate. Sets collimator controls for manual operation.
- iv) Checks that appropriate attachments are in place on the unit head, such as collimator holder, beta ionization chamber (for electron beam mode), tray for beam blocks with megavoltage equipment.
- v) If appropriate, obtains tray to hold lead blocks and attaches to accessory ring on unit head at prescribed height. May attach appropriate size collimator (for use with electron beam mode) to collimator holder in unit head.
- vi) If appropriate for the equipment, performer may adjust a centimeter scale for the prescribed SSD and insert it into the beam column to be used for the simulation.
- vii) If fluoroscopic equipment will be used for localization (if legal for performer), sets up as appropriate. May connect TV monitor, set up for automatic density control. May move image intensifier into position; may check that controls and timer are operative, as appropriate.
- viii) May check that remote control system is operative, as appropriate.

g. For isocentric or arc or rotation technique, sets up for simulation:

- i) If treatment table or couch is not permanently fixed in an isocentric position to the unit head, checks that correct treatment table for the field arrangement prescribed (such as one with open bottom when treatment head is to rotate

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underneath patient) is in place. If not already attached, detaches table currently in place by uncoupling as appropriate. Rolls table away from treatment head; rolls appropriate table into position and attaches as appropriate. If appropriate, slips proper insert into table opening.

- ii) May leave table attached but in uncoupled position if treatment for a stationary field is involved.
- iii) For arc or rotation, if treatment table is permanently fixed in an isocentric position to the unit head, checks that table is locked in place. If table is not fixed in isocentric position, couples unit and table as appropriate. Sets up so that treatment head is at zero degrees, with the center of the beam at the pendulum axis.
- iv) Checks that head of machine and gantry swivel are at zero degree position. Adjusts if necessary. Checks that treatment table is at zero degrees rotation. Checks side lights (which indicate the isocenter level (axis location) in the horizontal plane.

h. Performer checks that the proper materials are present:

- i) Checks for appropriate set-up accessories for positioning, immobilizing patient, blocking or filtering beam, making patient markings.
- ii) Checks for materials needed to make contour if appropriate.
- iii) Checks that procedure tray is equipped as appropriate for use of contrast materials, nursing care materials, set-up and layout materials, based on standard orders, special notes on requisition.

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iv) Checks for clean linens on table, pads, supports to make patient comfortable.

v) Makes sure that right (R) and left (L) markers are available for use and identification cards, leaded numerals, or markers. Prepares markers for identification of the localization or verification films if appropriate. Checks identification against requisition sheet.

vi) If field sizes are smaller than the capabilities of the collimator, checks that extension cones of appropriate sizes are available.

vii) Makes sure that an adequate supply of loaded cassettes of the appropriate types and sizes for the field arrangements and localization films are available in the room.

viii) If appropriate, slides esophagus board into position on treatment table.

ix) If grid films may be needed, selects the grid appropriate for the prescribed SSD or SAD and treatment machine to be used. Slides into slots on the accessory tray holder attached to the unit head.

x) If anything is missing, arranges to obtain or decides to obtain personally.

i. If a filter has been prescribed for use in beam column, checks that appropriate type for the HVL to be achieved is available. May insert in unit head above accessory holder. When using filter of more than one metal, e.g., copper and aluminum, may make sure that filter is inserted with aluminum side nearest the table and facing away from the target.

j. Performer obtains film in cassette or holder of type appropriate for the equipment, and size appropriate for the first field to be laid out.

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i) Attaches identification information as appropriate and places in position such as under table in bucky, cassette tray or tunnel, or in vertical holder.

ii) If right angle localization films are to be made, prepares two cassettes so that AP and lateral exposures can be made with beam column first in vertical position and then in horizontal position, at 90° to first position. Sets up two cassettes in holders so that each film will be at right angles to the central ray for the given position of beam column.

k. Performer may review the appropriate technical factors for the area of interest, field size and SSD involved to obtain diagnostic films, or, if gamma ray beam films will be made, reviews the rad exposure or exposure time to use to provide the image. May refer to the technique chart for the equipment.

5. Performer readies the patient for the simulation and initial treatment setup:

a. Performer washes hands as appropriate. Depending on patient's condition and the materials involved, carries out appropriate antiseptic and aseptic techniques.

b. Performer has the patient brought from the holding area and prepared for the procedure (if not already done), or decides to do personally. Depending on institutional arrangements, performer may decide to assist in bringing patient to the simulation or treatment room.

c. Performer greets patient and may accompany staff person and/or family member present and introduces self.

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Checks patient's identity against the requisition sheet. With in-patient, checks hospital identifier. Checks with any accompanying staff member on any special precautions necessary during procedure.

d. Performer makes patient comfortable on the simulation table, couch, chair, or as appropriate to the type of treatment planned.

   i) If appropriate, moves treatment table and has patient on stretcher moved into position for treatment.
   ii) If patient is in wheelchair, may move patient in chair into position next to table. Makes sure that wheelchair is in locked position.
   iii) Performer may decide to assist patient to table or has this done. May obtain help. Makes sure that no equipment is in the way that may be collided with by patient.
   iv) If assisting patient to step on footstool in order to get on table, helps patient turn into position, step backwards on stool, and then sit and/or lie on table.
   v) If patient has a life support system in place, such as respiration, cardiac or infusion equipment, makes sure that this is being monitored.
   vi) If there is wet dressing, performer has it reinforced or decides to do personally.
   vii) Makes sure patient is being attended and there is no danger patient will fall off table.

e. Performer carefully explains to patient and/or family member the purpose of the simulation and set-up procedures and what to expect. Uses language appropriate to patient's level of comprehension.

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   i) Explains to patient and/or family member what steps will be carried out, what positions patient will be in, what immobilization devices will be used, what cooperation will be asked of patient.
   ii) Notes that radiation therapy patients may be concerned or frightened about the procedures involved. May explain the radiotherapy process.
   iii) Explains that the external radiation will not make the patient become radioactive, and that patient will not be a hazard to anyone.
   iv) Explains that the radiation for filming and/or treatment produces no sensation.
   v) Explains the need for immobilization devices.
   vi) Explains why patient will be in separate room for treatment, how patient remains under observation, and shows how patient can communicate with performer during filming and/or treatment. May practice using intercommunication system.
   vii) Explains equipment in layman's terms if patient is concerned about the massive appearance of the equipment.
   viii) Explains how patient can help by remaining perfectly still during the filming and treatment.

f. If not already done, has patient appropriately undressed as for treatment and draped with sheet, if appropriate.

g. Performer attempts to establish a supportive relationship with the patient while preparing for the procedures. If necessary may converse through interpreter.

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i) Performer exercises care in reassuring patient while treating patient with dignity and compassion, bearing in mind that patient is suffering from a malignant disease that may be terminal, or with uncertain or poor prognosis. Without being blandly optimitsic, performer tries to put patient at ease.

ii) Considers the patient's psychological state, noting that the diagnosis may have been recent. Notes that patient may be frightened, emotionally disturbed, or may be incoherent, depressed, withdrawn, bitter, or hostile. Performer attempts to exercise consideration, respect, understanding, and as much warmth as possible. Treats patient with dignity and concern regardless of patient's behavior.

iii) Performer is careful to be supportive of the patient with respect to the patient's self-concept, body image, and acceptance of the situation that there is a disease condition to be treated or palliated.

iv) If the performer will be the staff member to regularly administer the treatment, performer attempts to develop a trusting relationship of mutual respect. Makes note of the patient's general appearance, behavior, and emotional affect in order to be aware of any marked changes in the patient over the course of treatment.

v) If performer notes any unusual behavior or physical indication, or if patient is in an unusually agitated state or in great pain, performer may notify radiotherapist without alarming patient.

vi) If sedative, analgesic or other medication is prescribed, performer proceeds as appropriate, allowing time for medication to to take effect.

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vii) Performer answers patient's or family member's non-medical questions honestly; attempts to reassure patient and develop confidence. If performer notes that a patient or patient's family is misinformed about the treatment objectives, such as whether treatment is for palliation or for curative care, performer brings this to the attention of the radiotherapist in charge so that the physician can clarify the purpose of the treatment to the patient or family members involved.

viii) If questioned about medical prognosis, performer refers patient to his or her attending radiotherapist and indicates that refusal is result of ethical considerations rather than unwillingness to deal with patient. Performer does not lie or invent information.

ix) Performer discusses the patient's case only with the radiotherapist in charge, unless required in order to carry out the procedure.

h. Performer may check whether a photograph has been taken of the patient for identification purposes:

i) Notes whether photograph of the area to be treated is required for record of pre-treatment appearance.

ii) Notes whether photograph is required of the treatment set-up and field arrangement.

iii) May plan to take photograph personally or have this done at appropriate time.

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i. Performer may have special procedures to localize or visualize internal organs carried out at appropriate point in the procedure. Notifies appropriate staff person unless performer will do personally:

  i) May request that staff member such as radiotherapist mark anatomical and localization points such as center of field in one or two axes for isocenter technique, and/or upper or lower edge of field.
  ii) May assist while radiotherapist inserts tube and BB shot to localize esophagus and/or the level of the tumor within the esophagus.
  iii) May have barium contrast mixture or paste prepared. Administers orally to patient or has this done at proper time.

6. Performer sets up the patient for the first treatment field area to be localized depending on the proposed treatment technique, the type of equipment to be used, and the size and position of the field. Is careful not to dislodge any support apparatus or IV.

  a. If the proposed treatment plan calls for arc or rotation therapy or isocenter technique for multiple stationary fields, positions patient on table so that set-up can be done for the direct field that will be used as reference for the moving field or for the first frontal stationary field.
  b. If the proposed treatment plan calls for a pair of direct parallel opposed fields (two symmetrically placed fields opposite one another, e.g., two lateral fields or anterior and posterior), chooses the anterior or posterior or lateral field which is to be the first one localized, and positions patient accordingly.

    i) For moving strip technique, performer begins the localization by treating the entire area of interest as though a set of parallel opposed fields were involved. Plans to outline the entire field, and then divide each field into strips of equal widths, such as 2.5 cm, so that different groups of strips can be treated according to plan, first in the anterior field and then in the posterior field, with single strips added and then dropped until all the strips have had homogeneous irradiation with minimal creation of overlapping "hot spots." Performer chooses the anterior or posterior total field area as the first to be localized and positions the patient accordingly.
    ii) If the proposed treatment plan calls for a pair of parallel opposed fields with the beams entering at an oblique angle, chooses the first oblique field and continues as with a single field with obliquely incident angle of entry.

  c. If the proposed treatment plan calls for a stationary multiple converging field arrangement (arrangement of three or more treatment fields, all converging on the tumor), without isocenter technique, studies the proposed field arrangement. Notes whether these are to be treated as symmetrical sets of direct parallel opposed

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fields (i.e., opposite one another from the point of view of beam entry and exit) and/or fields in which the incident beams enter obliquely at an angle to one another, or any combination of these. Chooses the first field for localization and positions patient accordingly. Chooses a direct field before doing any that require an oblique angle of entry.

d. If the proposed treatment plan calls for an obliquely incident beam, performer positions patient as ordered or studies the diagnostic or localization films provided to estimate the location and size of the tumor, the angle of entry and the field location required to include the tumor in the effective beam and avoid sensitive tissues.

e. If patient is to have treatment field dimensions changed or verified, or if the patient is to have the estimated isocenter point R corrected to the actual isocenter point T, performer notes the markings already on the patient and checks these against the written records.

f. Places, assists, or has patient assume the appropriate position for the first treatment field, such as lying supine on table for anterior or lateral portals, prone for posterior field (if under-table tube will not be used) or seated erect.

  i) May have patient lie supine, centered on table, with arms above head. Centers to midline marker on table.

  ii) May have patient lie prone with chin in chin support on esophagus board. Adjusts board to appropriate angle. Has patient grasp support posts.

  iii) May have patient sit erect in chair; may adjust immobilization shell to hold patient in fixed position. May plan to have portal cut out of the device after laying out treatment field.

  iv) For rotation or arc therapy, adjusts and immobilizes patient's arms so that they will not be in the line of the central beam or any moving parts.

g. If isocenter sidelight marks have been indicated, such as preliminary R triangulation marks, performer adjusts table height until sidelight beams strike the marked points on either side of patient. Otherwise adjusts to appropriate table height and estimated STD or SAD.

h. Adjusts the simulator or treatment head to the prescribed SSD unless isocenter technique is being used:

  i) May use optical distance meter and collimator light system with cross-hair shadow as reference for center of useful beam. May use centimeter scale set in beam column placed in direct contact with patient's skin.

  ii) Using center reference point, cross-hair shadows, distance indicator, or the distance at which the centimeter scale touches the skin (or shell), adjusts height of beam column and/or table height to the prescribed SSD.

  iii) For field surfaces that are not flat, performer measures SSD as prescribed, such as from center of field, at shortest possible SSD, or at a level half the distance of the spread from the shortest and longest possible SSD in the treatment field.

  iv) In the case of a shell, allows for the thickness of the shell, since this will be cut away to create the treatment field.

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i. If isocenter technique is not being used, performer may check or determine the beam angulation, and entry and/or exit portals of fields created by obliquely incident beams using a back pointer or a pin and arc device.

  i) If both the entry and exit points are accessible and have been marked, performer may attach back pointer to accessory ring of beam column and adjust unit head until the tip of the back pointer coincides with the marked position of exit of the central ray. Records the angle obtained.
  ii) If beam directing is needed, if the beam column does not have an angle scale, and if only the entry mark is available, may attach pin and arc device to accessory ring of beam column. Adjusts so that the desired SSD is achieved with the beam column centered on the tumor. Records the resulting readings for the pin, arc and rod settings and the angle of entry of the central beam.

j. Adjusts collimator to include the area of interest and centers as appropriate:

  i) Centers to the marked or indicated approximate center of the field using cross-hair shadow of light beam or the image of the cross or center of the grid in the tray suspended from the unit head.
  ii) Adjusts the collimator opening to include an area somewhat larger than the anticipated field size. Includes all areas of interest such as the heart.
  iii) For split beam technique (use of half the collimated area as treatment portal), centers so that the cross-hair marker of the light system falls on the appropriate perimeter of the intended field, so that the treatment field will be obtained when half the collimated light area is blocked.
  iv) For a direct field, adjusts beam column to zero degrees so that central ray will enter field at right angles to the horizontal plane.
  v) For an obliquely incident beam field, adjusts unit head to the prescribed angle as described or uses collimator light to estimate the field. Adjusts beam angulation until the light cast covers the area of interest. Centers to estimated entry point and to include exit point. Records beam angulation obtained by reading indicator in beam column if not already done.

k. Performer applies any appropriate immobilization devices to keep patient in a constant position which is comfortable enough to maintain and appropriate for the tumor type, location, and the equipment to be used.

  i) May use weighted bags, foam rubber pads, head clamp, straps, tape, or other devices as prescribed or as deemed necessary.
  ii) May ask patient about how comfortable the position is and adjust if possible.
  iii) After patient has been immobilized, performer makes sure that patient is still able to make small movements necessary for normal circulation, respiration and other vital functions.

7. Performer may take localization films of the first portal area before outlin-

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ing the field. If so, may proceed as follows:

a. If appropriate, performer may measure the patient in order to select exposure factors. May use centimeter calipers to measure the thickness of the area to be radiographed in the direction in which the central ray of the x-ray beam (or treatment beam) will pass through the centered part from tube to film. Records for use in determining exposure factors.

b. Performer selects and sets the exposure factors for the first projection by consulting the technique chart(s) posted for the machine to be used.

   i) For diagnostic x-ray tube, locates the information needed for the body part and projection involved according to the centimeter thickness of the part as measured and the collimated field size to be used. Makes sure that technique relates to the combination of film type and speed and SSD or SAD to be used. Makes note of the kVp, mA, seconds of exposure time for the overhead exposure or fluoroscopy.

   ii) For gamma ray (beam film) exposure, notes whether equipment uses a timer or a dosimeter for exposure control. Notes the time or rad exposure to use to make localization film of the area.

c. Performer sets the technical factors selected in the control room.

   i) Makes sure machine is ready for use and set to the appropriate mode.

   ii) For diagnostic x-ray tube sets technical factors (kVp, mA, time), or as appropriate for automatic exposure timing.

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   iii) For fluoroscopy, sets up and adjusts TV monitor. Sets factors as appropriate for conventional viewing or automatic brightness control, depending on whether kVp or mA is automatically controlled.

   iv) For beam film sets time or rad exposure as appropriate.

d. Places radiopaque markers as appropriate to record center of field or checks that image of cross or center of grid will be recorded on film or seen on TV monitor.

   i) May place radiopaque marker on patient's field surface (skin or shell to be cut out) where the cross-hair shadow indicates the center of the field.

   ii) For isocenter technique may place a radiopaque marker at the center reference point (R) or the designated true center (T). May also place radiopaque markers at the nearest anatomical landmark.

   iii) May mark or place radiopaque markers where sidelight beams strike patient (at level of isocenter (R) or (T).

   iv) Places right or left markers and ID information as appropriate to be included in the film.

   v) May place a metal centimeter scale on the midline for calculation of magnification factor.

   vi) May record table height.

   vii) If exit point is relevant and can be determined with back pointer, pin and arc, or other device, may place radiopaque marker at center of exit portal.

   viii) When everything is ready for the exposure, explains to patient what will happen and the importance of holding still during

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exposure. May have patient practice holding still when requested until told to relax.

- ix) Makes sure everyone leaves the simulation or treatment room. Explains to patient that performer and other staff are nearby in control room and that patient is under observation.
- x) May have radiotherapist called to view fluoroscopic image if appropriate.

e. Performer returns to control room to make exposure.

- i) Makes sure controls are properly set and patient is still in position.
- ii) Tells patient when to hold still by calling or using intercom.
- iii) Initiates exposure by using appropriate exposure control, or activates fluoroscope control (if legal) and observes on TV monitor, or assists radiotherapist.
- iv) Makes sure exposure is terminated as appropriate.
- v) After exposure is completed tells patient that he or she can relax.

f. Unless fluoroscopy was used to localize the treatment area, or if the film will be kept in place for a second exposure of blocked out field area, performer removes the exposed cassette or film holder.

g. If lateral film(s) are to be made performer maintains patient in the same position.

- i) Sets up film in upright cassette or film holder that is at right angles to the plane of the AP or PA projection. Makes sure ID information will be marked on film.

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- ii) Sets up beam column so that it is at 90° angle to original position.
- iii) Centers so that the sidelight marker is at the midpoint of the film and central beam.
- iv) Collimates so that the radiopaque marker that was at the center of the frontal field (or anterior surface of patient) and the tabletop are included in the field.
- v) Recalculates and resets technical factors if necessary for lateral projection.
- vi) Repeats exposure as described.

h. If appropriate, repeats lateral filming on opposite side, referring to opposite side sidelight mark as center of field.

i. Has any exposed film(s) processed at once or decides to do personally.

j. If right-angle frontal and lateral films have been made to determine tumor depth, performer may place these on view boxes and/or present to radiotherapist so that the skin-to-tumor distance can be measured and added to the source-to-skin distance to obtain the source-to-tumor distance (source-to-axis distance).

- i) May use image of centimeter scale or grid and measurements on the film image to calculate a magnification factor or may use the known magnification factor to calculate the distances personally.
- ii) May locate the tumor on the radiograph and measure the skin-to-tumor distance on the radiograph with a centimeter scale or uses image of grid on film. Measures from the appropriate portion of the tumor to the skin surface.

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iii) Multiplies the measured distance on the radiograph by the magnification factor to find the actual skin-to-tumor distance. Records.

iv) Adds the skin-to-tumor distance to the known source-to-skin distance to arrive at the source-to-tumor distance. May measure the distance from the skin or tumor to the tabletop and record.

8. Performer takes the processed field localization film(s) to the radiotherapist or places on view boxes and calls radiotherapist. With fluoroscopy, has radiotherapist present during the exposure.

a. Notes the radiotherapist's orders on the centering, placement and dimensions of the first field.

i) With isocenter technique may receive order on final isocenter position (T).

ii) With fluoroscopy performer notes comments from radiotherapist or own observations to adjust the field to include or exclude organs or tissues from the useful beam. Between exposures may move radiopaque marker as directed or decide personally to mark center of field.

iii) Performer may examine films personally and check that the areas of interest are visible, that the appropriate features such as radiopaque markers, scale, organs have been localized. Repeats filming if radiographs are inadequate, noting reason for problem to avoid future "retakes".

iv) Performer may bring the processed radiograph to radiotherapist, or displays on view box as appropriate. Receives instructions on the exact location and dimensions

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of the portal or assists radiotherapist while he or she draws in the outline of the portal on the radiograph.

b. Performer uses fluoroscope image or processed radiograph(s) and light system to establish the first field outline.

i) With beam film, if the film is to be left in place, performer proceeds to outline the first field using light system, collimator and beam blocks according to specifications, leaving film in place.

ii) Performer may readjust centering, beam angulation, SSD, SAD or immobilization of patient based on radiotherapist's orders.

iii) May draw in field on radiograph according to specifications by connecting the appropriate points indicated by image of grid lines on radiograph.

c. When the field is outlined on the radiograph and if the grid or cross method is to be used, performer places the radiograph with the field outlined on the patient's field surface.

i) Uses the light system and adjusts the film so that the shadow of the grid center or cross cast by the light beam coincides with the image of the cross on the radiograph.

ii) May center with reference to image of radiopaque marker and cross-hair shadow.

d. Performer collimates to the exact field size specified so that the light cast from the collimator exactly coincides with the field

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drawn on the radiograph (or specified in relation to the center marker and anatomical reference points on the patient).

- i) If the field is irregularly shaped or if the field will be defined with beam blocks as well as collimator, performer may position beam blocks on tray attached to unit head above patient so that the light cast exactly fits the field as drawn or specified. Makes sure that beam block tray is at prescribed height.
- ii) For split beam technique, performer sets the collimator to twice the length of the prescribed field size so that the cross-hairs of the light beam are on the border of the field when blocked. Then uses beam block or special collimator to block appropriate half of the light area.

e. When ready to outline field on patient, performer removes the radiograph from the patient's treatment surface.

f. If the field outline is to be verified, performer outlines the perimeter of the light field on the patient's body (or on the surface of any shell where cut-outs will be made). Uses radiopaque strips to define the perimeter of the field. Maintains the SSD or SAD, beam angulation, centering, and immobilization of patient.

- i) When the field has been outlined by the radiopaque strips, performer may open collimator so that the areas included and those excluded from the field can be visualized on the portal film.
- ii) With a double-exposure beam film, maintains collimation and blocking so that the second exposure indicates the treatment field (superimposed on first exposure).

9. Performer makes a verification portal film of the first portal as appropriate for approval:

a. Unless original beam film is still in place for second exposure, performer places an identified cassette or film holder in position. Centers to the midpoint of the field as outlined.

- i) Sets up using approved geometry for stationary or isocenter technique as appropriate, as described.
- ii) May prepare for fluoroscopy and call radiotherapist as described.

b. Sets or resets technical factors as appropriate, as described above.

c. Clears room; has patient hold still; makes exposure or activates fluoroscope and views on TV monitor as described above.

d. Considers the adequacy of the field lay-out.

- i) With fluoroscopy, performer may assist while radiotherapist views image on TV monitor; may view personally. Adjusts radiopaque strips between exposures as directed or decided.
- ii) With verification portal film, has radiograph processed as described above, and views processed radiograph; then places for viewing by radiotherapist.
- iii) Performer may first personally consider whether the strips and/or angle of beam column have been properly chosen to include all of the treatment volume without unnecessary exposure of healthy tissue. Repeats steps

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described above until performer is satisfied that the field has been properly defined and outlined. Has radiotherapist view film.

e. During review by radiotherapist performer notes any orders for changes in field dimensions, centering, beam angulation, or blocking.

  i) Performer adjusts the field dimensions and shape as ordered by moving the strips, adjusting block and/or collimator, and/or beam angulation as ordered.
  ii) May take additional films or carry out fluoroscopy as described above until the portal dimensions are approved.
  iii) Performer is careful not to make more exposures than is absolutely necessary to have accurate portal defined and recorded on film.

10. If a wedge filter or wedge pair treatment fields have been prescribed, performer may proceed as follows:

  a. Notes the wedge size prescribed for the first field, its angle, the orientation of the thicker end of the wedge, and the angle of incidence to the field.
  b. Measures the dimensions of the first wedge field as laid out and approved. Records.
  c. Performer checks whether the wedge filter size available for the machine will accomodate the needs of the patient's field width as measured. If not, reports this to radiotherapist and follows alternative procedure as ordered.
  d. Selects wedge filter according to size prescribed from wedge selector and inserts in accessory ring.

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  i) For wedge pair makes sure that heel of wedge is properly placed in relation to second field (at appropriate "hinge angle").
  ii) May check that a pinpoint of light at the thin end of wedge filter is visible on the field and that no strip of light is visible from the beam column on the patient's body.
  iii) If no pinpoint of light is visible, performer reports that wedge size is too large; if strip of light is visible, performer may recommend a larger size for wedge filter.
  iv) Performer follows alternative procedure as ordered and repeats check if appropriate.

11. At appropriate point during procedure, especially for isocenter technique, performer applies triangulation marks to ensure duplication of the set-up position.

  a. With patient and equipment in the approved position, records the center of the field, and/or the center of the exit portal. Marks with appropriate dye on patient and/or as appropriate on shell.
  b. Marks both approved points where side lights indicate the isocenter level for the field.
  c. Performer records the exact position in which the patient is to lie for the treatment including position of arms and any supporting and/or immobilization devices.

12. At appropriate point during procedure, performer may have a contour prepared, duplicating the patient's body surfaces at the level of the tumor. May request that this be done by co-worker such as physicist, or decides, if appropriate, to do so personally.

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13. If the treatment technique calls for the moving strip field technique, performer measures the appropriate horizontal or vertical dimension of the first treatment field and calculates the number of standard size (2.5 cm) divisions that can be included. Performer marks these off on the patient's body, using vegetable dye, and draws in the vertical or horizontal lines. May mark strip numbers. Records the number of strips and orientation (vertical or horizontal) on form to be used to record strip treatments.

14. When the first portal dimensions have been approved, notes whether any areas of normal tissue are to be blocked out. May proceed as follows:

    a. Performer may mark out areas to be shielded on the approved portal film using marker. Refers to instructions, image of areas made radiopaque with the use of contrast medium, or anatomical reference points or marks. May have radiotherapist draw in areas to be blocked. The performer may personally judge the areas to be blocked by referring to patient markings, by palpating, or by referring to localization films.
    b. If skip-scan technique is prescribed for arc or rotation technique (in order to protect sensitive tissues by having shutter closed while beam traverses those areas), notes angular increments and sets preselection controls in order to make check.
    c. May position loaded cassette or film holder as described earlier.

        i) Centers the marked-out portal film on the surface of the patient or on the surface of the shell to be cut out. Uses the

List Elements Fully

light system and projected image of the cross or the crosshair shadow to line up the center of portal film with beam colum. Checks that tray is at proper height.
        ii) Performer notes whether beam blocks will be placed in tray attached to accessory ring in beam column, or whether areas to be blocked will be outlined with wire so that blocks of prescribed HVL can be fabricated.
        iii) May place beam blocks of the prescribed HVL on tray in arrangement to coincide with field dimensions and to block area to be protected from radiation as drawn on radiograph on patient's field surface. May insert beam blocks between the two layers of the tray, insert into holder, clamp into position. Checks that the shadows cast by the blocks correspond with the areas to be shielded.
        iv) If blocks are to be fabricated, performer may lay out areas to be blocked by placing lead wires on the grid placed in the blocking tray so that their shadow, cast by the light beam, corresponds with the outline on the radiograph or as marked on the patient's body.

    d. When the performer determines that the areas to be blocked are all outlined or shadowed, performer repeats the filming of the portal as described earlier.
    e. To check set-up and blocking using arc or rotation, performer may proceed as follows without making exposure:

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i) Notes prescribed degree(s) of rotation and initial direction for arc movement. Notes whether peeling technique (off-axis rotation) is prescribed and at what angle unit head is to be tilted.
ii) Collimates to the direct field just outlined.
iii) For rotation therapy sets the angle of rotation by setting the switch for direction of rotation to zero. Sets the prescribed angle for rotation, and sets the rotation pre-selection button.
iv) For arc therapy sets the direction of the rotation to the left or right depending on the direction in which the arc movement is to commence. Sets the prescribed pendulum (arc) angles using the appropriate controls.
v) Performer sets the prescribed speed of movement.
vi) For skip-scan technique, sets tabs for angular increments over which shutter will be closed.
vii) Moves all cords or other objects out of the way of the rotation field.
viii) Checks the rotation movement by using control to start; checks pendulum movement by turning pendulum direction control all the way to the left or right as appropriate. May check whether proper syncronization of table and unit head is accomplished. If not, stops movement using appropriate control and adjusts as needed.
ix) Makes a series of portal films, such as at anterior or posterior positions and at predetermined oblique or lateral projections, or uses fluoroscopy and watches on TV monitor while source head moves across the patient's total field. Has films processed.

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x) For arc or rotation performer checks whether the tumor remains at the center of the fluoroscopic path and field as collimated (or in the center of the series of portal films). If at any point along the arc of rotation the tumor is not in the center of the field as collimated, performer stops the rotation of the simulator or treatment head. Rechecks calculations and settings and repeats the appropriate steps after recording new settings and/or measurements.
xi) Takes any processed portal films to the radiotherapist for approval.
xii) Makes any corrections in lay-out as ordered and repeats as appropriate until the field lay-out has been approved.
xiii) Performer has radiotherapist indicate approval of final portal set-up as appropriate, such as with signature on film(s).
xiv) May arrange to have photographs taken of final set-up if appropriate, or decides to do personally.

15. Performer makes record of the field outline and blocking set-up so that it can be duplicated for treatment:

a. If beam blocks were used, performer traces the approved outlines on the patient's skin using dye or ink. Follows outline of the shadows cast by the beam blocks on the tray, or the outline of the wires laid out on the tray.
b. If beam blocks were used, performer may make a record of the prescribed HVL and the arrangement on the beam block tray (beam block diagram):

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i) May use the grid on the tray to record location of the beam blocks. Removes blocks.

ii) Performer may insert a plain plastic plate into a slot in the beam block tray. Draws outline of approved field dimensions and areas within field to be blocked using wax pencil. Places tip of pencil on the plate so that its shadow falls on the patient. Follows the markings on the patient's field surface so that the pencil duplicates on the plate the markings laid out on patient.

iii) Performer may remove the plate and tape lead wire onto the plate, covering the wax markings made of the field arrangement to duplicate the field lay-out. Performer then replaces the plate in the tray. Opens collimator beyond field borders. Checks that the image of the wires lines up with the field markings on the patient. Adjusts as appropriate.

c. If the portal is to be cut out of shell, performer indicates the dimensions of the window to be cut by drawing in lines connecting the radiopaque strips, including areas to be shielded.

i) Performer may indicate that a hole already cut needs to be enlarged. Draws in enlargement lines or measures and records the enlargement needed.

ii) Performer removes the shell and has the window cut out according to the dimensions indicated.

iii) When the shell is returned, performer repeats the set-up using the light system, and checks that the appropriate portal has been created.

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iv) May repeat filming of portal to make sure that the cut-out provides an accurate field.

d. If not already done, performer outlines the exposure field on the patient's skin using ink or dye.

i) Makes sure to mark field outline, center of field, entry and exit points, side light marks, areas for blocking, strip areas for moving strip technique and strip numbers.

ii) If appropriate, if skin marks may fade, or if permanent marks are needed, performer may assist while radiotherapist tattoos marks at the center, and/or corners of field using hypodermic needle and ink.

e. Measures the field marked on the patient's body with centimeter ruler and records as appropriate.

f. Unless the radiopaque strips for the first field will be used for locating other fields, performer removes strips.

16. Throughout the procedure, performer observes the patient for any signs of emergency and/or to prevent or respond to an accident. Is alert to signs of nausea, dizziness, or sweat, suggesting faintness. Notifies nurse or radiotherapist at once. If patient shows any emergency signs, loses consciousness, or has an accident, performer calls appropriate physician or nurse at once. May decide to provide emergency first aid as well.

17. If a second treatment field is to be set up and verified, performer may proceed as follows:

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a. For isocenter technique performer maintains the patient and SAD in position and rotates treatment head to other field positions while maintaining tumor at the center of the central beam, allowing the SSD to vary as necessary. Lays out additional fields as described, collimating to correct field sizes and designing beam block arrangements as appropriate.

b. For parallel opposed fields without isocenter technique, may proceed as follows:

   i) If the opposed fields are anterior-posterior, performer has the patient turn over. Assists patient if appropriate, or has co-worker assist. Performer realigns the patient so as to reproduce the reverse of the same field (the posterior view if anterior view has just been localized).

   ii) If the opposed fields are lateral fields and permit the use of side lights for set-up, performer uses measurements or markings already made to find the center of the first field. Adjusts the table position so that one of the beams of light is cast on the center mark. Then marks the place where the opposite light beam strikes the reverse side; marks and treats as center of field. May repeat with other field boundary points.

   iii) If the opposed fields are arranged at an oblique angle of incidence, performer uses beam directing devices and/or side lights as described above; refers to tumor and center markings on the patient.

   iv) Repeats all the appropriate steps already described for the first field, but uses all the measurements obtained for the first

List Elements Fully

field in order to reproduce them directly for the second field.

c. For the moving strip field technique, performer removes patient's immobilization devices and assists patient in exposing the second (opposite) full field area.

   i) Marks out the second full field area as for parallel opposed direct fields, as described above.

   ii) Repeats the markings on the second field, including the marking of the field strips so that the second full field is an exact duplication of the first.

   iii) May determine the average depth represented by the treatment volume. Uses calipers to measure the distance between the opposite field surfaces at a standard number of points. Records. Performer calculates the average of these depths and records on the appropriate form.

d. For wedge-pair fields, performer notes or is told the estimated dimensions, the location of the second field, and the angle prescribed between the two fields.

   i) For the second field performer adjusts the beam column to the required angle of incidence to achieve the prescribed "hinge angle" between the fields, as ordered. Records the angle as read on the beam column angle scale.

   ii) Adjusts beam column to the prescribed SSD as described, making measurement from the designated area of the field.

   iii) Collimates to the field area indicated. Outlines field and re-

TASK DESCRIPTION SHEET (continued)

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cords measurements as described above.

- iv) Checks second wedge filter as described above. Makes sure to insert second filter so that the heel of the two wedge filters will lie towards each other.

e. Performer follows instructions on the separation between fields. Measures distances between the first field outlined and the second field as indicated by the light system, using centimeter scale.

f. Performer checks to make sure that no fields overlap to avoid "hot spots" (overlap of areas of high irradiation in other than volume of interest).

- i) Leaves strip markers in place for any direct fields laid out.
- ii) Tries to avoid hot spots due to overlap of fields at exit portals by using fluoroscopy and/or portal films to note whether the lead outlines of direct fields overlap with exit portals of non-parallel fields on the opposite side of the patient. If performer judges that there is exit portal overlap of the fields, repeats field layout and localization procedures as appropriate until there is no such overlap, or reports to radiotherapist.

g. Performer measures and records the angle of incidence for each field to be entered obliquely. Measures and records the distances between each field, using a flexible centimeter scale.

h. Performer repeats localization of portal area, outlining of field with radiopaque strips and dye, planning of beam blocking, preparation of cut-outs as described earlier.

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- i) If ordered, performer repeats any or all steps to adjust the localization and field set-ups until they are approved by radiotherapist.
- ii) Washes off discarded field outlines with soap and water.
- iii) Records final field dimensions, beam column angles, and/or wedge filter sizes when approved.

18. Performer continues as described for any third or more fields to be set up and verified.

19. If performer has any questions or has encountered any problems with the set-up, such as structural impediments to achieving the plan at the prescribed angles, restrictions on the movement of the equipment or on the patient's mobility, discusses with radiotherapist if not already done and continues as ordered.

20. Performer checks that all records are complete and that custom-made devices are accounted for:

a. Performer makes sure that the final verification portal films are identified with patient identification information and with indications of the views involved. May include patient's name and number, physician's name, date, type of film, machine number.

b. Records all the relevant information such as field sizes, separations, beam angulation, SSD or SAD.

c. Assembles the patient's chart, films, simulation sheet, any special equipment such as immobiliza-

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tion devices, shell, cut-outs, contours. Arranges to have these given or sent to the appropriate co-worker.

d. If not already done, may have photograph(s) taken of the field set-up(s).

e. When the radiotherapist indicates that all procedures have been completed, carefully removes any beam directing or immobilization devices from patient and replaces in appropriate locations.

  i) Has any devices to be used again by the patient identified.
  ii) Moves the beam column out of the way.

f. Performer may make sure that all the measurements and information needed to calculate the daily given dose and tumor dose are properly recorded on the appropriate form(s).

g. After or if the treatment plan is approved, may check that a copy is placed in the folder to be used by the radiation therapy technologist.

21. Performer may discuss with patient what has been done in order to make clear what procedures the patient must follow in order to be properly treated. If appropriate, talks through interpreter, and/or talks with family member accompanying patient:

a. Performer explains the importance of retaining the body markings which outline the field area(s). Depending on the material used, indicates whether washing is prohibited.

b. Performer explains any prohibitions on use of cosmetics or toiletries on field area, if appropriate.

c. Performer explains any preparatory procedures before treatment as appropriate.

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d. If institutional policy, performer may answer questions about or inform patient about side effects that can be expected with the treatment, such as skin reactions, nausea, fever, loss of appetite, discomfort in retrosternal area, throat.

e. Encourages patient to report skin reactions, changes in eating habits, fluid intake and output, bowel movements, and persistent nausea or pain,or difficulty in breathing or swallowing to the radiotherapist or nurse so that these can be noted and help provided.

f. May arrange to have a check list prepared and given to patient or family member to reinforce the instructions.

22. Performer notes whether patient is to be scheduled next for special localization procedures, such as tomography, transverse axial tomography, or computerized transverse axial tomography, so that dose calculations can be made. Notes whether patient is to go directly to treatment, back to room, or to any other scheduled location.

a. If appropriate, makes sure that designated staff person is there to bring patient to appropriate next location.

b. May decide to assist patient to leave; may decide to transport personally; or may have this done.

c. May indicate to appropriate staff person when the performer is ready to proceed with next simulation and/or initial set-up.

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
Code 565
This is page 1 of 3 for this task.

Performer's Name________________ **Analyst(s)**________________ **Dept.**________
Job Title________________ **Institution**________________ **Date**________

1. **What is the output of this task?** (Be sure this is broad enough to be repeatable.)

Simulation and initial set-up for proposed treatment plan carried out;localization,verification portal films made,approved;treatment fields,triangulation marks,areas to be blocked laid out,marked on pt.; blocking diagram made;arrangements made to have contour, bolus prepared;field dimensions recorded; pt. reassured, given explanation,instructions;records entered for use.

2. **What is used in performing this task?** (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt.'s proposed treatment plan,requisition sheet, ID card,bracelet,medical-technical chart,prior radiographs,scans;view boxes,simulator or treatment machine;controls,TV monitor,intercom;fluoroscope; distance,beam angle indicators;table;light system;collimator;beam accessory holder;blocking tray;split beam auxiliary collimator or applicator;rolling ball inclinometer;support bar,grid;compression breast bridges;bolus;rice bags;arm board;contour;scales, rulers;x-ray film,holders;cassettes;cassette holder; wax markers;immobilization devices;breast board;lead shielding;radiopaque cross,metal grid,markers,strips, ID markers;beam blocks;beam direction device,pin and arc,back pointer;side lights;wire;plastic plate;tape; scissors;dye,ink,sticks;pen,pencil;pt. instructions; stretcher,wheelchair;forms;soap,water;calipers

3. **Is there a recipient, respondent or co-worker involved in the task?** Yes...(X) No...( )

4. **If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved.**

Any radiotherapy patient;radiotherapist; co-worker; physicist ; family member; nurse

5. **Name the task so that the answers to questions 1-4 are reflected. Underline essential words.**

Carrying out simulation and initial set-up for any pt. to receive external beam radiation therapy of the breast(s) using simulator or treatment machine by reviewing proposed treatment plan;preparing equipment; reassuring,preparing,explaining procedure to pt.; positioning,immobilizing pt. for treatment using proposed geometry;laying out direct,tangential parallel opposed or oblique treatment fields using isocentric or rolling ball inclinometer technique; taking localization,verification portal films;obtaining approval for set-up;having bolus,contour made;preparing split beam blocking;marking field lay-outs,triangulation points on pt.;recording field dimensions,geometry; explaining self care,after-effects,danger signs to pt.;disassembling approved set-up;recording.

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Performer carries out simulation and initial treatment set-up procedures for any patient scheduled to receive external beam radiation therapy of the breast(s).

1. General initial steps include finding out what is being requested, who is involved, proposed treatment plan, condition of patient, purpose of treatment,tumor volume(s), equipment to be used, SSD or SAD, set-up techniques to be used, accessories to be prepared and/or used, what outputs are required from this particular simulation, and special considerations.

2. This task is similar to Task Code 564 except as follows:

   a. Treatment volumes may include chest wall and regional nodes in the internal mammary region, axillary region, and supraclavicular region on the ipsilateral side. Notes whether bilateral or unilateral treatment is involved.

      i) Performer notes what will be included in tumor volume, location of fields in relation to predetermined reference or central lines and anatomical landmarks.

      ii) Field arrangements include direct field(s),

OK-RP;RR;RR

6. **Check here if this is a master sheet..**(X)

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This is task ___ of ___ for this performer.
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Performer's Name ______________ Analyst(s) ______________ Dept. ________
Job Title ______________ Institution ______________ Date ________

List Elements

medial and lateral (parallel opposed) tangential chest wall fields, non-parallel opposed tangential fields.

iii) The mastectomy scar is included in the treatment field.

b. Equipment can include megavoltage electron beam therapy, such as linear accelerator, betatron, and/or cobalt-60 teletherapy.

c. Set-up techniques include use of isocenter or rotation mechanism and/or a rolling ball inclinometer to measure the separation and angles of tangential fields.

d. Set-up equipment may include, in addition, any or all of the following:

  i) Breast board, bar to immobilize breast, support grid (if bolus is not used).

  ii) Tangential compression breast bridges.

  iii) If bolus is used, rice bags to fill in space between bridge plates.

e. Set-up procedures may include preparation of a bolus to bring the depth dose to the surface for chest wall tangential fields. (See Task 563.) If so, performer checks that proposed treatment plan includes instructions on the frequency with which bolus is to be used.

f. May have a contour prepared at appropriate point in procedures.

g. In setting up fields, performer may arrange the beam blocking so that any overlapping of adjacent borders of fields (such as internal mammary and medial tangential fields) can be compensated by blocking on appropriate treatment days to provide homogeneous dose.

h. For tangential fields, performer uses a special breast cone applicator or auxiliary collimator to provide use of split beam technique, to eliminate penumbra and divergence and to spare healthy tissues.

i. Positioning of patient may be as follows:

  i) For chest wall, anterior axillary and supraclavicular fields, has patient assume supine position on table, with head turned to the contralateral side. Does not use pillows unless convexity of upper chest is extreme. Abducts upper arm 90°. Supports forearm in upright position with vertical arm board.

  ii) For posterior axillary field, has patient assume prone position with head turned to the contralateral side, with forearm rotated down, the shoulder in contact with the table top, and back of hand on pelvic brim. Does not use pillows.

3. Task follows the general outline of the models:

  a. Performer checks that everything to be used is ready. Reviews diagnostic radiographs, scans.

  b. Checks that staff to assist or to be involved in set-up, or to approve portal films or set-up arrangements, are ready or available.

  c. Checks that patient is identified, available, and properly prepared. May check that incision is recorded as completely healed if prior surgery has been carried out. Checks that consent has been signed.

  d. Greets patient; explains what will be done; makes note of patient's condition, behavior, general state.

  e. Readies patient for simulation and initial set-up. Positions for first field.

  f. Takes any localization films; has them approved. Receives further in-

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 3 of 3 for this task.

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Performer's Name____________ Analyst(s)____________ Dept.________
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List Elements	List Elements
formation on first field dimensions, beam angulation. g. Outlines first field. Takes verification portal film; has it approved. Receives further information on blocking, shielding. h. Blocks in areas to be protected; makes verification portal film; has it approved. i) Has bolus made. ii) Has contour made. i. Marks on patient approved field dimensions, triangulation marks, center of field, beam directional marks. Has appropriate marks tattooed. j. Records field dimensions, SSD, beam angulation; may make blocking diagram. k. Continues with additional fields. l. Checks that all permanent records are made, photographs taken, signatures obtained. m. Provides patient with instructions on self care, care of treatment markings, danger signs to report. n. When procedures are completed, disassembles equipment; sees that patient is escorted or directed to next location; places materials and records for use.	

TASK IDENTIFICATION SUMMARY SHEET

Code 566

This is task ___ of ___ for this performer.
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Performer's Name________________ **Analyst(s)**________________ **Dept.**________
Job Title________________ **Institution**________________ **Date**________

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Simulation and initial set-up for proposed treatment plan carried out;localization,grid films,wire films, verification portal films made,approved;treatment fields,triangulation marks,areas to be blocked laid out and marked on pt.;blocking ordered with use of wire films;measurements made;compensating filter ordered;final verification films of blocks,fields, shielding,field arrangements made,approved;dimensions,geometry recorded;pt.reassured,given explanation,instructions;records entered for use.

2. What is used in performing this task?

Pt.'s proposed treatment plan,requisition sheet, ID card,bracelet,medical-technical chart,prior radiographs,scans;view boxes;simulator or treatment machine,controls;intercom;distance,beam angle indicators;table;light system;collimator;beam accessory holder;blocking tray;mantle board;scales,rulers; x-ray film,holders,cassettes;wax markers;immobilization devices;metal grid,grid plate;metal cross; radiopaque markers,strips;wire,wire plate;ID markers; beam blocks;blocking bridge;male gonadal shielding; side lights;tape;scissors;dye,ink,sticks;pen,pencil; pt.instructions;stretcher,wheelchair;forms;soap,water

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved.

Any radiotherapy patient;radiotherapist; co-worker; physicist; family member; nurse

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Carrying out simulation and initial set-up for any pt. to receive external beam radiation therapy of the lymph nodes with mantle and/or "inverted-Y" field techniques or variations using simulator or treatment machine by reviewing proposed treatment plan;preparing equipment;reassuring,preparing,explaining procedure to pt.;positioning,immobilizing pt. for treatment using proposed geometry;laying out direct,anterior mantle, "inverted-Y", or component fields,parallel opposed fields using SSD or isocenter technique; taking field localization grid films;having fields, areas to be shielded marked out;making wire films; taking measurements based on approved wire films; marking field outlines,centering,triangulation marks on pt.;having compensating filter,lung block molds fabricated;and/or preparing beam blocks in plate diagram;making verification portal films of final set-up;recording field dimensions,separations,blocks, geometry;explaining self care,after-effects,danger signs to pt.;disassembling approved set-up;recording.

List Elements

Performer carries out simulation and initial treatment set-up procedures for any patient scheduled to receive external beam radiation therapy of the lymph nodes with "mantle" and/or "inverted-Y" technique (treatment of all major lymph nodes above and/or below the diaphragm; i.e., total nodal irradiation, including the lymph node chains above the diaphragm and/or the para-aortic, spleen or spleen pedicle, pelvic, inguinal femoral regions, or a variation).

1. General initial steps include finding out what is being requested, who is involved, purpose of simulation, equipment for simulation, the treatment machine, proposed treatment plan, proposed fields, arrangements, locations, areas to be blocked and/or shielded, set-up techniques to be used, outputs required from this particular simulation, and special considerations.

2. This task is similar to Task Code 564 except as follows:

   a. Notes whether this simulation is to verify the treatment fields and provide approved films from which lung blocks, other blocks and/or compensatory filters will be fabricated, whether it is to verify the adequacy of the fabricated blocks, field designations and set-up, whether to retailor blocks

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

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Job Title ____________________ Institution ____________________ Date __________

List Elements

as the disease regresses, to correct error found during course of treatment, based on treatment verification films.

b. Notes the field arrangements, such as mantle, inverted-Y field, use of individual aortic and pelvic fields, whether parallel opposed or modified posterior mediastinal field, whether splenic bed will be included in inverted-Y field, whether a small posterior portal will be used for spleen.

c. Notes equipment to be used, such as linear accelerator, betatron, cobalt-60 megavoltage. Notes whether patient will be maintained in supine position and isocenter technique will be used to treat posterior fields from under the table (with treatment head rotated).

d. Notes areas to be blocked and/or shielded, such as cerebellum, larynx, trachea, heart-lungs, and humeral heads for mantle fields; spinal cord for posterior fields; kidney(s), liver, normal tissue, surgically transposed ovaries, testicles, for inverted-Y fields or modifications of inverted-Y field.

  i) Notes whether a mantle board will be used for positioning.
  ii) Notes type of blocking and shielding to be used, such as styrofoam molds filled with lead for lung blocks, use of lead, beam-shaping shadow tray blocks, and/or conical gonadal cups for testicles, bridge with lead bricks for protection from any leakage.
  iii) Notes what combination of lung blocks are required to provide for anterior and posterior fields.

e. Notes whether measurements are required so that compensating filters can be custom made to be used in treatment to achieve dose homogeneity.

f. Depending on the purpose of the simulation and stage of preparation for treatment, performer checks that patient markings to indicate field boundaries, isocenter, anatomical landmarks and/or areas to be blocked have been made by radiotherapist.

g. May arrange for injection of radiopaque iodine-based contrast to make kidneys visible on portal films. May instruct patient in need to breathe shallowly and hold as still as possible during filming and/or treatment.

h. May assist while more senior staff member positions patient for grid and/or wire films.

i. Positions patient for anterior mantle portal in supine position, with head extended and immobilized, arms above head and immobilized in precise, duplicable predetermined position.

j. Depending on stage of simulation and set-up, may cover the following steps:

  i) With tentative field boundaries and anatomical reference lines marked on patient and localized with radiopaque markers and IVP, makes field localization grid films with simulator or treatment machine in treatment position using treatment geometry. Sets SSD or SAD as prescribed or at height allowing the entire field to be covered by the collimated central ray as shown by light system.
  ii) Has radiotherapist change and/or approve field dimensions; marks field borders, isocenter, triangulation marks on patient and/or has radiotherapist tattoo.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
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List Elements

iii) Has radiotherapist draw in on the grid film the outlines of the areas to be blocked (from which styrofoam mold and/or beam blocks will be fabricated after wire films are approved), and mark level at the lateral border of the lung image where the lung block will not require a tapered edge (to ensure complete shielding of area not being treated).

iv) Transfers pattern to grid plates or has this done.

v) Makes wire films on which the pattern has been traced with wires, with patient and treatment machine or simulator in treatment position using treatment geometry.

vi) Repeats as appropriate for posterior (parallel opposed or modified) fields.

vii) Once wire films are approved, makes appropriate measurements; records. Has beam blocks, other blocks and/or shielding fabricated; may have compensating filter fabricated.

viii) Once all the blocks and/or shields and/or molds are prepared, positions patient and simulator or treatment machine in treatment position with treatment geometry. Makes verification portal film. Repeats for each anterior field and each posterior field.

ix) Makes sure to provide appropriate shielding for testicles, beam blocks for transposed ovaries.

x) Has radiotherapist approve final set-up. Has photographs taken.

3. Task follows the general outline of the models:

a. May check that incision is recorded as completely healed if prior surgery was done; checks that consent form has been signed.

List Elements

b. Performer checks that everything to be used is ready. Reviews diagnostic radiographs, scans.

c. Checks that staff to assist or direct set-up procedures, inject contrast, approve or modify portal films or set-up arrangements are ready or available.

d. Checks that patient is identified, available, and properly prepared.

e. Greets patient; explains what will be done; makes note of patient's condition, behavior, general state.

f. Readies patient for simulation and initial set-up. Positions for first field.

g. Takes any localization and/or grid films;has them approved. Receives further information on first field dimensions, beam angulation.

h. Outlines first field. Takes verification portal film; has it approved. Receives further information on blocking, shielding.

i. Either uses standard blocks and/or makes wire films based on marked-out areas on portal films to prepare blocking or have the blocks or mold, and/or any needed bolus fabricated. May have contour made.

j. Continues with all other fields.

k. Marks on patient approved field dimensions, triangulation marks, center of field,beam directing marks.

l. Measures, records field dimensions, SSD or SAD, beam angulation; may make blocking diagram.

m. Makes final verification portal films; sets up as for treatment. Obtains signature approving set-up. Has photographs made.

n. Provides patient with instructions on self care, care of treatment markings, danger signs to report.

o. When procedures are completed, disassembles equipment; sees that patient is escorted or directed to next location; places materials and and records for use.

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
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Performer's Name__________ Analyst(s)__________ Dept.__________
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1. **What is the output of this task?** (Be sure this is broad enough to be repeatable.)

Simulation and initial set-up for proposed treatment plan carried out;localization and verification portal films made,approved;treatment fields,triangulation marks,areas to be blocked laid out and marked on pt. and approved;blocking diagram made;field dimensions,geometry recorded;strip fields laid out; pt. reassured,given explanation,instructions;contour, tomography ordered;records entered for use.

2. **What is used in performing this task?** (Note

Pt.'s proposed treatment plan,requisition sheet, ID card,bracelet,medical-technical chart,prior radiographs,scans;view boxes;simulator or treatment machine,controls;intercom;distance,beam angle indicators;table;light system;collimator;beam accessory holder;blocking tray;scales,rulers;x-ray film,holders,cassettes;cassette holder;wax markers;immobilization devices;air insufflators;IVP procedure tray; cervical localizer,vaginal probe;catheters;barium enema;lateral field bridge;strip field collimators; metal grid,grid plate;metal cross;radiopaque markers, strips,wire,wire plate,ID markers;beam blocks; beam direction device,pin and arc,back pointer; side lights;tape;scissors;dye,ink,sticks;contour;pen,pencil;pt. instructions;stretcher,wheelchair;forms; soap;water

3. **Is there a recipient, respondent or co-worker involved in the task?** Yes...(X) No...( )

4. **If "Yes" to q. 3:** Name the kind of recipient, respondent or co-worker involved.

Any radiotherapy patient;radiotherapist; co-worker; physicist; family member; nurse

5. **Name the task** so that the answers to questions 1-4 are reflected. Underline essential words.

Carrying out simulation and initial set-up for any pt. to receive external beam radiation therapy of the whole abdomen,or female patient to receive external beam radiation of the reproductive system, using simulator or treatment machine by reviewing proposed treatment plan;preparing equipment;reassuring,preparing,explaining procedure to pt.;positioning,immobilizing pt. for treatment using proposed geometry;arranging for localization procedures such as IVP,barium enema,insertion of vaginal probe;laying out direct,parallel opposed,isocentric,arc or rotation,or moving strip treatment fields;taking localization,verification portal films;calculating STD;obtaining approval for set-up;preparing beam blocking diagram;marking field lay-outs,triangulation points on pt.;recording field dimensions,geometry;having contour,tomograms made;explaining self care,aftereffects,danger signs to pt.;having catheter,enema, probe removed;disassembling approved set-up; recording.

List Elements

Performer carries out simulation and initial treatment set-up procedures for any patient scheduled to receive external beam radiation therapy of the whole abdomen, or female patient to receive external beam radiation therapy of the whole abdomen, pelvis, lower pelvis, or lateral pelvic structures and regional lymph nodes (with center areas blocked to reduce the dose to the bladder and rectum,when the central strip is treated with intracavitary radiation).

1. General initial steps include finding out what is being requested, who is involved, purpose of simulation, equipment to be used for simulation, for treatment, the proposed treatment plan, the proposed field arrangements and locations, SAD or SSD, areas to be blocked, set-up techniques to be used, outputs required from this particular simulation,and special considerations.

2. This task is similar to Task Code 564 except as follows:

   a. Performer notes the areas to be treated and the field arrangements, such as parallel opposed abdominal and/or pelvic fields, four-field technique, moving strip technique, direct fields,or arc or rotational technique.
   b. Notes the areas to be blocked, such as the kidneys (in posterior field),

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6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
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Performer's Name__________ **Analyst(s)**__________ **Dept.**__________
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List Elements

liver, corners of field, central areas (such as strip including bladder, rectum, vagina, cervix).

c. Notes the areas to be visualized with special procedures, such as use of radiopaque calibrated cervical localizers or metal vaginal probe, catheterization of urethra with air insufflator and contrast solution to outline bladder, catheterization of rectum and/or instillation of barium enema, intravenous injection of iodine-based contrast (IVP) to visualize kidneys.

  i) Notes at what stage the procedures will be done and by whom.
  ii) Checks patient's allergies to contrast and reports if appropriate.

d. Notes equipment to be used, such as linear accelerator, betatron, cobalt-60 megavoltage. Notes whether special collimator will be selected for moving strip technique. If so, notes strip sizes to be used.

e. Notes sequence of events.

  i) May plan to assist in insertion of vaginal or cervical localizer, use of caliper on stand between patient's legs, use of fluid level and vertical pointer to mark the lowest level of palpable vaginal disease or cervix on surface of patient's body. Places marker at vaginal entrance.
  ii) May assist with catheterization, barium enema.
  iii) May assist in or personally mark anatomical reference points and approximate anterior boundaries with calibrated and or other radiopaque markers.
  iv) May make AP and/or lateral localization film, help determine the center of the lateral portals or lateral triangulation marks. Notes adjustments ordered.

List Elements

  v) May use a bridge to set up lateral fields.
  vi) Calculates SSD or SAD if not already done, at height allowing the entire field to be covered by the central ray as required and shown by light system.
  vii) May lay out anterior field and make verification films.
  viii) May assist with IVP, instruct patient of need to breathe shallowly and hold still during filming and/or treatment.
  ix) Lays out areas to be blocked using wire grid on patient, taking portal films, and blocking areas first on films and then verifying markings on patient.
  x) Prepares block diagram or blocking plate, or records.
  xi) Lays out strip fields as appropriate using special collimator.
  xii) Takes final verification portal films.
  xiii) Has areas to be blocked, triangulation marks, field perimeters, center of field, corners, other reference points tattooed, and/or personally marks with dye on patient's body.
  xiv) Repeats steps with posterior fields, lateral fields.
  xv) Records all dimensions, geometry.
  xvi) Has contour made at appropriate level. May send patient for tomography at prescribed level or decides to do personally.
  xvii) After procedure, has probes, catheters, enema removed or decides to do personally.

3. Task follows the general outline of the models:

  a. Performer checks that everything to be used is ready. Reviews diagnostic radiographs, scans. Checks that incision is healed from prior surgery, that consent form has been signed.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
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Performer's Name__________ Analyst(s)__________ Dept.______
Job Title__________ Institution__________ Date______

List Elements	List Elements
b. Checks that staff to assist or direct set-up procedures, catheterize patient, insert vaginal probe, inject contrast, administer enema, approve or modify portal films or set-up arrangements are ready or available. c. Checks that patient is identified, available, and properly prepared. d. Greets patient; explains what will be done; makes note of patient's condition, behavior, general state. e. Readies patient for simulation and initial set-up. Positions for first field. f. Takes any localization and/or lateral films; has them approved. Receives further information on first field dimensions. g. Outlines first field. Takes verification portal film; has it approved. Receives further information on blocking. h. Blocks in areas to be protected; makes verification portal film; has it approved. i. Marks on patient approved field dimensions, triangulation marks, center of field, beam directional marks. May have contour made. j. Records field dimensions, SSD or SAD, beam angulation; may make blocking diagram. k. Continues with additional fields. l. Checks that all permanent records are made, photographs taken, signatures obtained. m. Provides patient with instructions on self care, care of treatment markings, danger signs to report. n. May send patient to have tomography. o. When the procedures are completed, has catheters, probes, enema removed; disassembles equipment; sees that patient is escorted or directed to next location; places materials and records for use.	

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
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Performer's Name________________ **Analyst(s)**________________ **Dept.**________
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1. What is the output of this task?

Simulation and initial set-up for proposed treatment plan carried out;localization and verification portal films made,approved;treatment fields laid out; triangulation marks,areas to be blocked laid out and marked on pt. and approved;field dimensions,geometry recorded;wedge filters checked;pt.reassured,given explanation,instructions;contour,tomography ordered; records entered for use.

2. What is used in performing this task?

Pt.'s proposed treatment plan,requisition sheet, ID card,bracelet,medical-technical chart,prior radiographs,scans;view boxes;simulator or treatment machine,controls;TV monitor;intercom;fluoroscope;distance,beam angle indicators;table;light system;collimator;beam accessory holder;blocking tray;scales, rulers;x-ray film,holders,cassettes;cassette holder; wax markers;immobilization devices;air insufflators; catheterization sterile procedure tray;localizer bridge;barium enema materials;contrast media;syringes;metal grid,grid plate;metal cross;radiopaque scale markers,strips,wire,wire plate,ID markers;beam blocks;beam direction device,pin and arc,back pointer;side lights;tape;scissors;dye,ink,sticks;contour; pen,pencil;pt. instructions;stretcher,wheelchair; forms;soap;water;bolus bag;wedge filters

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved.

Any radiotherapy patient;radiotherapist; co-worker; physicist; family member; nurse

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Carrying out simulation and initial set-up for any pt. to receive external beam radiation therapy of the whole pelvis,urinary bladder,or male pt. to receive external beam radiation of the prostate,using simulator or treatment machine by reviewing proposed treatment plan;preparing equipment;reassuring,preparing,explaining procedure to pt.;positioning,immobilizing pt. for treatment using proposed geometry;assisting with localization such as bladder catheterization,barium enema;taking frontal and lateral localization films,marking center on pt. and film;laying out parallel opposed direct or oblique fields,multiple converging,or anterior oblique wedge fields;using prescribed SSD or arc or rotation isocenter technique and obtaining SAD;taking verification portal films;obtaining approval for set-up;preparing beam blocking;marking field lay-outs,triangulation points on pt.;checking wedge filters;recording field dimensions,geometry,wedge filter dimensions;having contour,tomograms made;explaining self care,after effects,danger signs to pt.;having catheter,enema removed;disassembling approved set-up;recording.

List Elements

Performer carries out simulation and initial set-up procedures for any patient scheduled to receive external beam radiation therapy of the whole pelvis, urinary bladder, or male patient to receive external beam radiation of the prostate.

1. General initial steps include finding out what is being requested, who is involved, purpose of simulation, equipment to be used for simulation and for treatment, the proposed treatment plan, field arrangements and locations, SAD or SSD, areas to be blocked or avoided, set-up techniques to be used, outputs required from this particular simulation, and special considerations.

2. This task is similar to Task Code 564 except as follows:

   a. Performer notes the localization precedures to carry out or arrange to have carried out, such as catheterization of patient's urethra;instillation of air and/or positive contrast in catheter balloon and in urinary bladder, insertion of catheter or enema tip in rectum; instillation of air and/or barium contrast in rectum.

      1) Notes whether any marker was implanted during prior surgery, such as a gold grain in prostatic nodule.

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
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List Elements

ii) Notes whether the position of the prostate and/or bladder are to be localized and treatment fields laid out at the same time that larger pelvic fields are localized (so that the reduced fields can be used at a later stage of therapy without the patient discomfort and danger of infection which accompanies catheterization after irradiation of tissues).

iii) Notes at what stage procedures will be done and by whom.

b. Performer notes the areas to be treated, such as total pelvis (sparing the rectum as much as possible), total bladder, selected areas of involvement (sparing as much of bladder and rectum as possible).

c. Notes equipment to be used, such as linear accelerator, betatron, cobalt-60 megavoltage.

d. Notes field arrangements such as lateral arc or rotational moving fields, or stationary fields such as parallel opposed direct or oblique fields, multiple converging fields, anterior oblique wedge fields.

  i) Notes whether isocenter technique will be used to determine the center of tumor or treatment volume. Notes whether the procedure is to determine the initial isocenter (R) or to plan final setup based on corrections from R to true tumor center (T).

  ii) Notes whether patient is to be treated in supine and/or prone position, whether localization films will be made in supine and/or prone position.

e. Notes localization devices to be used, such as calibrated skin strip or centimeter scale, localization bridge with markers showing distance from table top, lateral and vertical center markers.

f. Assists or arranges to have patient's urethra catheterized with Foley catheter, and enema tip or second catheter inserted in rectum. Follows aseptic procedures as appropriate.

g. Has patient lie in supine or prone position, centered to midline.

  i) Centers film as appropriate to first field area and center of beam.

  ii) Uses radiopaque marker to show center of beam. Marks on patient.

  iii) Assists while bulb of urinary catheter is filled with mercury or other positive contrast (and air), and while radiopaque contrast(and air) is instilled in bladder.

  iv) Tapes catheter into position.

  v) Sets SSD as prescribed or uses isocenter controls at mid-plane depth as appropriate, including balloon in upper surface. Marks side lights.

  vi) May use calibrated skin strip or localization bridge and distance markers. Places bolus bag to fill in natal cleft (between buttocks).

  vii) Makes portal film. Has reviewed. Has center of bladder and portal boundaries outlined.

  viii) Marks patient and places radiopaque marker indicating center of bladder or estimated isocenter of field (R).

h. Sets up for lateral films with patient's position maintained and unit head rotated 90°.

  i) Assists while barium (and air) is instilled in rectum.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
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Performer's Name __________ Analyst(s) __________ Dept. __________
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List Elements

ii) Centers film in vertical holder as appropriate using side lights, localization marker.
iii) Takes lateral portal film(s).

i. Follows appropriate procedure to locate preliminary isocenter (R) or adjusted isocenter (T) and/or calculate skin-to-tumor distance.
j. If patient will be treated in both prone and supine positions, repeats for reverse position. Marks posterior border of contrast-filled bladder on all radiographs and translates as exterior marks on patient for centering.
k. Removes catheter syringes; clamps enema, catheter(s); may have contour made. May have patient moved for transverse tomography.
l. Lays out first direct field with marks showing perimeter of field, center, and side lights. Has approved or adjusts until approved.
m. Lays out additional fields adjusting as needed to spare as much of rectum, healthy tissues as possible.
n. Carries out appropriate procedures to check wedge filters for anterior oblique wedge fields.
o. At end of procedure has balloons and catheters emptied; has catheter, enema removed, or does personally, following aseptic technique.

3. Task follows the general outline of the models:

a. Performer checks that everything to be used is ready. Reviews diagnostic radiographs, scans.
b. Checks that staff to assist or direct set-up procedures, catheterize patient, insert enema tip, instill contrast, administer enema, approve or modify portal films or set-up arrangements are ready or available.

List Elements

c. Checks that patient is identified, available, and properly prepared.
d. May check that incision is recorded as healed from any prior surgery, that consent form has been signed.
e. Greets patient; explains what will be done; makes note of patient's condition, behavior, general state.
f. Readies patient for simulation and initial set-up. Assists with localization procedures. Positions for first field.
g. Takes any localization and/or lateral films; has them approved. Receives further information on first field dimensions or isocenter.
h. Outlines first field. Takes verification portal film; has it approved. Receives further information on blocking. May have contour made. May send patient for transverse tomography.
i. Blocks in areas to be protected; makes verification portal film; has it approved. Checks wedge filters.
j. Marks on patient approved field dimensions, triangulation marks, center of field, beam directional marks. May have marks tattooed.
k. Records field dimensions, SSD or SAD, beam angulation; may make blocking diagram.
l. Continues with additional fields.
m. Checks that all permanent records are made, photographs taken, signatures obtained.
n. Provides patient with instructions on self care, care of treatment markings, danger signs to report.
o. When the procedures are completed, has catheters, enema removed; disassembles equipment; sees that patient is escorted or directed to next location; places materials and records for use.

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
This is page 1 of 3 for this task.

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Performer's Name ____________________ Analyst(s) ____________________ Dept. __________
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1. **What is the output of this task?** (Be sure this is broad enough to be repeatable.)

Simulation and initial set-up for proposed treatment plan carried out;localization and verification portal films made,approved;treatment fields,triangulation marks,areas to be blocked laid out and marked on pt. and approved;blocking diagram made;field dimensions,geometry recorded;pt. reassured,given explanation,instructions;contour,tomography ordered; records entered for use.

2. **What is used in performing this task?** (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt.'s proposed treatment plan,requisition sheet, ID card,bracelet,medical-technical chart,prior radiographs,scans;view boxes;simulator or treatment machine,controls;intercom;distance,beam angle indicators;table;light system;collimator;beam accessory holder;blocking tray;scales,rulers;x-ray film,holders,cassettes;cassette holder;wax markers;immobilization devices;testicle shielding or positioning device;metal grid,grid plate;metal cross;radiopaque markers,strips,wire,wire plate,ID markers;beam blocks;beam direction device, pin and arc, back pointer;side lights;tape;scissors;dye,ink,sticks; contour;pen,pencil;pt.instructions;stretcher,wheelchair;forms;soap;water

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. **If "Yes" to q. 3:** Name the kind of recipient, respondent or co-worker involved.

Male radiotherapy patient;radiotherapist;co-worker; physicist; family member; nurse

5. **Name the task** so that the answers to questions 1-4 are reflected. Underline essential words.

Carrying out simulation and initial set-up for male pt. to receive external beam radiation therapy of the testis using simulator or treatment machine by reviewing proposed treatment plan;preparing equipment; reassuring,preparing,explaining procedure to pt.;positioning,immobilizing pt. for treatment using proposed geometry;laying out A and P parallel opposed "inverted T" or "L-shaped" fields at correct SSD;taking localization,verification films;blocking and/or excluding remaining testis and part of scrotum as ordered;obtaining approval for set-up;preparing beam blocking diagram;marking field lay-outs;triangulation points on pt.;recording field dimensions,geometry; having contour,tomograms made;explaining self care, after-effects,danger signs to pt.;disassembling approved set-up;recording.

List Elements

Performer carries out simulation and initial set-up procedures for a male patient scheduled to receive external beam radiation of the testis.

1. General initial steps include finding out what is being requested, who is involved, the purpose of simulation, equipment to be used for simulation and for treatment, the proposed treatment plan, proposed field arrangements and locations, SSD, areas to be blocked or avoided, set-up techniques to be used, outputs required from this particular simulation, and special considerations.

2. This task is similar to Task Code 564 except as follows:

   a. Performer notes the areas to be treated and the field arrangements.

      i) Notes whether tumor area is unilateral, and side on which orchiectomy has been done. Plans to include orchiectomy scar in anterior field.

      ii) Notes whether parallel opposed, anterior and posterior L-shaped or T-shaped fields are prescribed, and suggested boundaries.

      iii) Notes whether the treatment volume will be irradiated by single anterior and posterior fields or by subdivided

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
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Performer's Name________ Analyst(s)________ Dept.______
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List Elements Fully

fields. May plan to adjust SSD to include the required field length and to use beam blocks to shape the field.

iv) Notes whether remaining testis is to be irradiated or shielded, whether scrotum and/or portion of scrotum is to be included in treatment field.

v) Notes what type of equipment will be used to shield the remaining testicle, such as hemispherical lead shields, lucite holder to isolate testicle from central beam (while irradiating portion of scrotum, if appropriate). Notes whether bolus will be used.

b. Notes equipment to be used, such as cobalt-60 or other megavoltage equipment.

c. Notes sequence of events.

i) May assist in or personally mark anatomical reference points and approximate anterior boundaries with calibrated and/or other radiopaque markers.

ii) May make AP and/or lateral localization film, help determine dimensions of the portals and triangulation marks. Notes adjustments ordered.

iii) May position isolating or shielding device to keep remaining testicle and any portion of scrotum to be blocked out of beam.

iv) Determines the SSD, if not already done, at height allowing the entire field to be covered by the central ray as required and shown by light system. Records.

d. May lay out anterior field(s) and make verification films:

i) With tentative field boundaries and anatomical reference lines marked on patient and localized with radiopaque markers, makes field localization grid films with simulator or treatment machine in treatment position using treatment geometry.

ii) Sets SSD as prescribed or at height allowing the entire field to be covered by the collimated central ray as shown by light system.

iii) Has radiotherapist change and/or approve field dimensions. Marks field borders, triangulation marks on patient and/or has radiotherapist tattoo.

iv) Has radiotherapist draw in on the grid film the outlines of the areas to be blocked.

v) May make wire films after having traced the pattern outlined with wires, with patient and treatment machine or simulator in treatment position using treatment geometry. Has radiotherapist review.

vi) Once wire films are approved, makes appropriate measurements; records. Orders beam blocks, bolus, other blocks and/or shielding fabricated, if appropriate.

vii) Takes final verification portal films. Has areas to be blocked, triangulation marks, field perimeters, center of field, corners, other reference points tattooed, and/or personally marks with dye on patient's body.

e. Repeats as appropriate for parallel opposed or modified posterior field(s).

3. Task follows the general outline of the models:

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 3 of 3 for this task.

Code 569

Performer's Name__________ Analyst(s)__________ Dept.______
Job Title__________ Institution__________ Date______

List Elements

a. Performer checks that everything to be used is ready. Reviews diagnostic radiographs, scans.
b. Checks that staff to assist or direct set-up procedures, inject contrast, approve or modify portal films or set-up arrangements are ready or available.
c. Checks that patient is identified, available, and properly prepared. May check that incision is recorded as healed from prior surgery, that consent form has been signed.
d. Greets patient; explains what will be done; makes note of patient's condition, behavior, general state.
e. Readies patient for simulation and initial set-up. May assist with positions for first field.
f. Takes any localization lateral and/or grid films; has them approved. Receives further information on first field dimensions.
g. Outlines first field. Takes verification portal film; has it approved. Receives further information on blocking, shielding, field separation.
h. Either uses standard blocks and/or makes wire films based on marked-out areas on portal films (to prepare blocking or have the blocks fabricated). May have contour made; may send patient for tomography.
i. Continues with other fields.
j. Marks on patient approved field dimensions, triangulation marks, center of field, corners, and/or has tattooed.
k. Measures, records field dimensions, separations, SSD; may make blocking diagram.
l. Makes final verification portal films; sets up as for treatment. Obtains signature approving set-up. Has photographs made.
m. Provides patient with instructions on self care, care of treatment markings, danger signs to report.

List Elements

n. When procedures are completed, disassembles equipment; sees that patient is escorted or directed to next location; places materials and records for use.

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.

Code 570

This is page 1 of 2 for this task.

Performer's Name ______________ Analyst(s) ______________ Dept. ______

Job Title ______________ Institution ______________ Date ______

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Simulation and initial set-up for proposed treatment plan carried out;device to hold penis and any bolus ordered or prepared;localization,verification portal films made,approved;treament fields,triangulation marks,areas to be blocked or shielded laid out, marked on pt.;blocking or shielding diagram made; field dimensions recorded;pt. reassured,given explanation,instructions;records entered for use.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt.'s proposed treatment plan,requisition sheet, ID card,bracelet,medical-technical chart,prior radiographs,scans;view boxes,simulator or treatment machine;controls,intercom;distance,beam angle indicators;table;light system;collimator;beam accessory holder;blocking tray;penis-holding box or jig with bolus;scales,rulers;x-ray film,holders;cassettes; cassette holder;wax markers;immobilization devices; lead shielding;radiopaque cross,metal grid,markers, strips,ID markers;beam blocks or lead shielding; beam direction device,pin and arc,back pointer;side lights;wire;plastic plate;tape;scissors;dye,ink, sticks;pen,pencil;pt. instructions;stretcher,wheelchair;forms;soap,water

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved.

Any radiotherapy patient;radiotherapist;co-worker; physicist; family member; nurse

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Carrying out simulation and initial set-up for male pt. to receive external beam radiation therapy of the penis using simulator or treatment machine by reviewing proposed treatment plan;preparing equipment; reassuring,preparing,explaining procedure to pt.; positioning,immobilizing pt. for treatment using proposed geometry;laying out direct,lateral parallel opposed,narrow A and P bilateral lymph node fields; having device to hold penis (and bolus if ordered) prepared;taking localization,verification portal films;obtaining approval for set-up;preparing beam blocking or shielding;marking field lay-outs,triangulation points on pt.;recording field dimensions, geometry;explaining self care,after-effects, danger signs to pt.;disassembling approved set-up;recording.

List Elements

Performer carries out simulation and initial set-up procedures for a male patient scheduled to receive external beam radiation therapy of the penis.

1. General initial steps include finding out what is being requested,who is involved, the equipment to be used for simulation and for treatment, the proposed treatment plan, proposed field arrangements and locations, SSD, areas to be blocked or avoided, set-up techniques to be used, out-puts required from this particular simulation, and special considerations.

2. If superficial or deep x-rays are to be used, this task is similar to Task Code 563; if megavoltage equipment, such as cobalt-60 teletherapy is to be used, this task is similar to Task Code 564. Features unique to this task are as follows:

   a. Notes whether superficial x-ray, deep x-ray,or megavoltage equipment will be used and the machine.
   b. Performer notes areas of interest,such as small superficial tumors, larger tumors of penile shaft or urethra, and/or lymph node areas of the groin, external iliac, hypogastric areas.
   c. Notes proposed field layouts, such as single direct, or parallel opposed

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 2 of 2 for this task.

Code 570

Performer's Name__________ **Analyst(s)**__________ **Dept.**__________
Job Title__________ **Institution**__________ **Date**__________

List Elements

lateral fields, and bilateral, narrow anterior and posterior lymph node fields with the midline blocked.

d. Performer notes whether penis will be treated with bolus added (for use with megavoltage equipment).

   i) May obtain a special molded box to fit around the penis or jig to hold penis in upright position.
   ii) For megavoltage has the box or jig device include the bolus. May have device custom-made for patient.

e. If deep x-ray therapy is to be used, protects scrotum and testes with lead shielding which rests on thighs and anterior abdominal wall.

3. Task follows the general outline of the models:

a. Performer checks that everything to be used is ready. Reviews diagnostic radiographs, scans.
b. Checks that staff to assist or to be involved in set-up, or to approve portal films or set-up arrangements, are ready or available.
c. Checks that patient is identified, available, and properly prepared. May check that incision is recorded as completely healed from prior surgery. Checks that consent form has been signed.
d. Greets patient; explains what will be done; makes note of patient's condition, behavior, general state.
e. Readies patient for simulation and initial set-up. May have mold with bolus or jig prepared. Positions for first field.
f. Takes any localization films; has them approved. Receives further information on first field dimensions.
g. Outlines first field. Takes verification portal film; has it approved. Receives further information on blocking, shielding, field separation.
h. Blocks in areas to be protected or uses lead shielding, depending on equipment. Makes verification portal film; has it approved.
i. Marks on patient approved field dimensions, triangulation marks, center of field, beam directional marks. Has appropriate marks tattooed.
j. Records field dimensions, SSD, beam angulation; may make blocking or shielding diagram.
k. Continues with additional fields.
l. Checks that all permanent records are made, photographs taken, signatures obtained.
m. Provides patient with instructions on self care, care of treatment markings, danger signs to report.
n. When procedures are completed, disassembles equipment; sees that patient is escorted or directed to next location; places materials and records for use.

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
This is page 1 of 3 for this task.

Code 571

Performer's Name________________ Analyst(s)________________ Dept.________
Job Title________________ Institution________________ Date________

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Simulation and initial set-up for proposed treatment plan carried out;localization and verification portal films made,approved;treatment fields laid out;triangulation marks,areas to be blocked or shielded laid out and marked on pt. and approved;field dimensions, geometry recorded;pt.reassured,given explanation,instructions;contour,tomography ordered;records entered for use.

2. What is used in performing this task?

Pt.'s proposed treatment plan,requisition sheet, ID card,bracelet,medical-technical chart,prior radiographs,scans;view boxes;simulator or treatment machine,controls;TV monitor;intercom;fluoroscope;distance,beam angle indicators;table;light system;collimator;beam accessory holder;blocking tray;scales, rulers;x-ray film,holders,cassettes;cassette holder; wax markers;immobilization devices;shielding;sterile IVP procedure tray;contrast medium;metal grid,grid plate;metal cross;radiopaque scale markers,strips, wire,wire plate,ID markers;beam blocks;beam direction device,pin and arc,back pointer;side lights;tape; scissors;dye,ink,sticks;contour;pen,pencil;pt.instructions;stretcher,wheelchair;forms;soap,water

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Any radiotherapy patient;radiotherapist; co-worker; physicist;family member;nurse

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Carrying out simulation and initial set-up for any pt. to receive external beam radiation therapy of the kidney and/or adrenal glands or neuroblastoma using simulator or treatment machine by reviewing proposed treatment plan;preparing equipment;reassuring,preparing,explaining procedure to pt.;positioning,immobilizing pt. for treatment using proposed geometry; arranging for,assisting with IVP;laying out A and P parallel opposed and lateral fields at treatment SSD; taking localization,verification portal films excluding remaining kidney from fields as ordered;obtaining approval for set-up;marking field lay-outs,blocking, triangulation points on pt.;recording field dimensions,geometry;having contour,tomograms made;explaining self care,after-effects,danger signs to pt.;disassembling approved set-up;recording.

List Elements

Performer carries out simulation and initial treatment set-up procedures for any patient scheduled to receive external beam radiation therapy of the kidney and/or adrenal glands (especially a pediatric patient with nephroblastoma or neuroblastoma or an adult with hypernephroma).

1. General initial steps include finding out what is being requested, who is involved, patient's age, size, purpose of simulation, equipment to be used for simulation and for treatment, the proposed treatment plan, the proposed field arrangement and locations, the SSD, set-up techniques to be used, outputs required from this particular simulation, and special considerations.
   - a. Notes whether patient is to be treated immediately after surgery for prophylactic postoperative irradiation of the tumor bed, or is to receive pre-operative radiotherapy or radiotherapy in conjunction with a non-surgical modality.
   - b. Plans simulation as appropriate to patient's age, purpose and timing of the radiotherapy treatments.
2. This task is similar to Task Code 564 except as follows:

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 2 of 3 for this task.

Code 571

Performer's Name ______________ Analyst(s) ______________ Dept. ________
Job Title ______________ Institution ______________ Date ________

List Elements

a. Performer notes the areas to be treated and the field arrangements.

   i) Notes the side on which the tumor occurs.
   ii) Notes whether a pair of parallel opposed anterior and posterior fields will be used including the kidney and/or renal bed, the para-aortic glands, excluding the remaining kidney.
   iii) If patient is obese, may note the use of a supplementary lateral field.
   iv) Notes whether the glands around the remaining renal blood vessels and renal pelvis will be included in field.

b. Notes whether deep x-ray or megavoltage equipment will be used.

   i) If deep x-ray equipment is to be used, portions of Task Code 563 are relevant as well as Task Code 564.
   ii) If megavoltage equipment is to be used,Task Code 564 is relevant.

c. Notes when kidney(s) will be localized (so the remaining kidney can be excluded from the fields);and whether by IVP or renal isotope scan.
d. Checks whether patient may be allergic to iodine-based contrast medium.
e. Notes sequence of events.

   i) May assist with IVP, instruct patient of need to breathe shallowly and hold still during filming and/or treatment.
   ii) May assist in or personally mark anatomical reference points and approximate field boundaries with calibrated and/or other radiopaque markers.
   iii) May make AP and/or lateral localization film with with patient supine; may help determine dimensions of the portals and triangulation marks. Notes adjustments ordered.

f. Lays out anterior field with patient in supine position:

   i) Marks tentative field boundaries so as to exclude the remaining kidney, referring to anatomical reference points and localization films. Lays out field using radiopaque markers.
   Makes field localization grid and/or wire film with simulator or treatment machine in treatment position using treatment geometry.
   ii) Then has radiotherapist change and/or approve field dimensions. Marks field borders, center, triangulation marks on patient, and/or has radiotherapist tattoo the marks on the patient.
   iii) May use beam blocking for megavoltage or shielding for deep x-rays, if required, as ordered, to spare healthy tissues. Makes final verification portal films.

g. May have contour made at level of center of field (as marked or tattooed).
h. Continues with posterior parallel opposed field and any lateral field.

3. Task follows the general outline of the models:

   a. Performer checks that everything to be used is ready. Reviews diagnostic radiographs, scans.
   b. Checks that staff to assist or direct set-up procedures, carry out IVP, approve or modify portal films or set-up arrangements are ready or available.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 3 of 3 for this task.

Code 571

Performer's Name ____________ Analyst(s) ____________ Dept. ________
Job Title ____________ Institution ____________ Date ________

List Elements	List Elements
c. Checks that patient is identified, available, and properly prepared. d. May take special precautions with post-operative patient. e. Treats patient as appropriate to age (patient may be young child). Greets patient; may explain what will be done. Makes note of patient's condition, behavior, general state. f. Readies patient for simulation and initial set-up. Assists with IVP. Positions for first field. g. Takes any localization and/or lateral films; has them approved. Receives further information on first field dimensions. h. Outlines first field. Takes verification portal film; has it approved. Receives further information on shielding or blocking. i. If required, blocks in areas to be protected; makes verification portal film; has it approved. j. Marks on patient approved field dimensions, triangulation marks, center of field. May have marks tattooed. k. Records field dimensions, SSD; may make shielding or blocking diagram. l. Continues with additional fields. m. May have contour made. May send patient for transverse tomography. n. Checks that all permanent records are made, photographs taken, signatures obtained. o. Provides patient or family member with instructions on self care, care of treatment markings, danger signs to report. p. When the procedures are completed, disassembles equipment; sees that patient is escorted or directed to next location; places materials and records for use.	

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
Code 572 This is page 1 of 2 for this task.

Performer's Name__________ **Analyst(s)**__________ **Dept.**______
Job Title__________ **Institution**__________ **Date**______

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Simulation and initial set-up for proposed treatment plan carried out;localization and verification portal films made,approved;treatment fields laid out; triangulation marks,areas to be blocked laid out and marked on pt. and approved;field dimensions,geometry recorded;wedge filters checked;bolus,compensating filters ordered;pt. reassured,given explanation, instructions;records entered for use.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt.'s proposed treatment plan,requisition sheet, ID card,bracelet,medical-technical chart,prior radiographs,scans;view boxes;simulator or treatment machine,controls;TV monitor;intercom;fluoroscope;distance,beam angle indicators;table;light system;collimator;beam accessory holder;blocking tray;scales, rulers;x-ray film,holders,cassettes;cassette holder; wax markers;immobilization devices;metal grid,grid plate;metal cross;radiopaque scale markers,strips, wire,wire plate,ID markers;beam blocks;beam direction device,pin and arc,back pointer;side lights; tape;scissors;dye,ink,sticks;pen,pencil;pt. instructions;stretcher,wheelchair;forms;soap,water;bolus; wedge filters

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved.

Any radiotherapy patient;radiotherapist; co-worker physicist;family member;nurse

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Carrying out simulation and initial set-up for any pt. to receive external beam radiation therapy of the bone and/or soft tissue of an extremity using simulator or treatment machine by reviewing proposed treatment plan;preparing equipment;reassuring,preparing,explaining procedure to pt.;positioning, immobilizing pt. for treatment using proposed geometry; taking localization films;laying out parallel opposed (A and P or lateral), single direct,multiple converging or wedge fields,using prescribed SSD, isocenter technique,or adjusting SSD to required field length; taking verification portal films;obtaining approval for set-up;preparing beam blocking;marking field layouts,triangulation points on pt.;checking wedge filters;recording field dimensions,geometry,wedge filter dimensions;having compensating filter,bolus made; explaining self care,after effects,danger signs to pt.;disassembling approved set-up;recording.

List Elements

Performer carries out simulation and initial treatment set-up procedures for any patient scheduled to receive external beam radiation therapy of the extremities in connection with tumors of bone and/or soft tissue.

1. General initial steps include finding out what is being requested, who is involved, the purpose of simulation, equipment to be used for simulation and for treatment, the proposed treatment plan, field arrangements and locations, SAD or SSD, areas to be blocked or avoided, set-up techniques to be used, outputs required from this particular simulation, and special considerations.

2. This task is similar to Task Code 564 except as follows:

   a. Performer notes field size and field arrangement, where surgery has been performed, and location of scar. May consider the following:

      i) Notes the area to be included in the treatment beam, areas to be spared by use of beam blocks.
      ii) Notes whether field arrangements include parallel opposed anterior and posterior or medial and lateral fields, a single appositional field, wedge pair fields

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 2 of 2 for this task.

Code 572

Performer's Name________________ Analyst(s)________________ Dept.________
Job Title________________ Institution________________ Date________

List Elements

(for soft tissue sarcoma). Notes whether entire length of an affected bone will be included in field.

- iii) For long fields notes whether two abutting fields will be used with a moving field abutment, or whether the entire length will be included in the treatment field by increasing the SSD.
- iv) Notes whether a bolus will be prepared and used to achieve build-up over the surgical scar.

b. For soft tissue sarcoma, notes whether field arrangement must avoid including the full circumference of the extremity in the treatment volume.

- i) Depending on the location of the tumor, may note that areas to be protected from treatment beam may include part of patella, healthy skin and subcutaneous tissue in upper medial thigh, anterior tibial chin, soles, back of heel, Achilles tendon.
- ii) Notes whether a tissue compensator filter will be prepared, wedge filters used.

3. Task follows the general outline of the models:

a. Performer checks that everything to be used is ready. Reviews diagnostic radiographs, scans.
b. Checks that staff to assist or to be involved in set-up arrangements, are ready or available.
c. Checks that patient is identified, available, and properly prepared. May check that incision is recorded as completely healed if prior surgery has been carried out. Checks that consent form has been signed.
d. Greets patient; explains what will be done; makes note of patient's condition, behavior, general state.
e. Readies patient for simulation and initial set-up. Positions for first field.
f. Takes any localization films; has them approved. Receives further information on first field dimensions, beam angulation.
g. Calculates SSD or SAD if not already done, at height allowing the entire field to be covered by the central ray as required and shown by light system.
h. Outlines first field. Takes verification portal film; has it approved. Receives further information on blocking, shielding.
i. Blocks in areas to be protected; makes verification portal film; has it approved.
j. May have bolus made.
k. May have compensating filter made.
l. Carries out appropriate procedures to check wedge filters for wedge fields.
m. Makes final verification portal films; sets up as for treatment. Obtains signature approving set-up. Has photographs made.
n. Marks on patient approved field dimensions, triangulation marks, center of field, beam directional marks. Has appropriate marks tattooed.
o. Measures, records field dimensions, SSD or SAD, beam angulation; may make blocking diagram.
p. Continues with additional fields.
q. Checks that all permanent records are made, photographs taken, signatures obtained.
r. Provides patient with instructions on self care, care of treatment markings, danger signs to report.
s. When procedures are completed, disassembles equipment; sees that patient is escorted or directed to next location; places materials and records for use.

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.

Code 573

This is page 1 of 2 for this task.

Performer's Name__________ Analyst(s)__________ Dept.__________

Job Title__________ Institution__________ Date__________

1. **What is the output of this task?** (Be sure this is broad enough to be repeatable.)

Simulation and/or initial set-up for proposed treatment plan carried out;localization and verification portal films made,approved;whole body single,direct treatment field laid out;triangulation marks,areas to be blocked laid out and marked on pt. and approved;field dimensions,geometry recorded;pt. reassured,given explanation,instructions;records entered for use.

2. **What is used in performing this task?** (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt.'s proposed treatment plan,requisition sheet, ID card,bracelet,medical-technical chart,prior radiographs,scans;view boxes;simulator or treatment machine,controls;intercom;distance,beam angle indicators;table;light system;collimator;beam accessory holder;blocking tray;scales,rulers;x-ray film, holders,cassettes;wax markers;immobilization devices; metal grid,grid plate;metal cross;radiopaque scale markers,strips,wire,wire plate,ID markers; beam blocks;beam direction device;side lights;tape;scissors;dye,ink,sticks;pen,pencil;pt.instructions;floor stretcher,wheelchair;forms;soap,water;whole body shell

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. **If "Yes" to q. 3:** Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Any radiotherapy patient;radiotherapist; co-worker; physicist; family member; nurse

5. **Name the task** so that the answers to questions 1-4 are reflected. Underline essential words.

Carrying out simulation and/or initial set-up for any pt. to receive external beam radiation therapy of the whole body by reviewing proposed treatment plan;preparing equipment;reassuring,preparing, explaining procedure to pt.;positioning,immobilizing pt. for treatment using proposed geometry;laying out whole body,single direct field and determining SSD for required field length;blocking areas to be protected;marking triangulation,center of field,positioning points;taking verification portal films; obtaining approval for set-up;explaining self care, after effects,danger signs to pt.;disassembling approved set-up;recording.

List Elements

Performer carries out simulation and/or initial treatment set-up procedures for any patient scheduled to receive external beam radiation therapy of the whole body (such as for chronic leukemia).

1. General initial steps include finding out what is being requested, who is involved, the purpose of simulation, equipment to be used for simulation and for treatment, the proposed treatment plan, any areas to be blocked, set-up techniques to be used, outputs required from this particular simulation, and special considerations.

2. This task is similar to Task Code 564 except as follows:

   a. Performer may position patient in a curved "C" position to reduce the size of the field. May plan on a single direct field. May record the exact position of the patient in "C" position.
   b. Performer may check a custom-made whole body shell. Sets up patient on floor stretcher. May have bolus fabricated.
   c. Sets the SSD at height that allows the entire patient (field) to be covered by the collimated central ray as shown by light system.

3. Task follows the general outline of the models:

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 2 of 2 for this task.

Code 573

Performer's Name__________ **Analyst(s)**__________ **Dept.**______
Job Title__________ **Institution**__________ **Date**______

List Elements	List Elements
a. Performer checks that everything to be used is ready. Reviews diagnostic radiographs, scans.	
b. Checks that staff to assist or to be involved in set-up, or to approve portal films or set-up arrangements are ready or available.	
c. Checks that patient is identified, available, and properly prepared. Checks that consent form has been signed.	
d. Greets patient; explains what will be done; makes note of patient's condition, behavior, general state.	
e. Readies patient for simulation and initial set-up. Positions for the field.	
f. Calculates SSD if not already done, at height allowing the entire field to be covered by the central ray as required.	
g. Collimates to the field (the parts of the body or whole body to be included).	
h. Blocks in any areas to be protected; makes verification portal film; has it approved or receives further information on blocking.	
i. Marks on patient approved localization, positioning, triangulation, centering marks. Has any appropriate marks tattooed.	
j. Measures, records field dimensions, SSD; may make blocking diagram.	
k. Makes final verification portal film; sets up as for treatment. Obtains signature approving set-up. Has photographs made.	
l. Checks that all permanent records are made, photographs taken, signatures obtained.	
m. Provides patient with instructions on self care, care of treatment markings, danger signs to report.	
n. When procedures are completed, disassembles equipment; sees that patient is escorted or directed to next location; places materials and records for use.	

TASK DESCRIPTION SHEET

Task Code No. 574

This is page 1 of 3 for this task.

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Cross-section contour prepared of radiotherapy patient at level ordered; field and triangulation markings transferred; contour identified and placed for use.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt.'s proposed treatment plan, requisition sheet, simulation or set-up records, medical-technical chart, portal films; view boxes; calipers; contour paper; ruler or cm. scale; pen, pencil; right angle scale; plaster of paris bandage, splints; lubricant; lead or solder wire; water; scissors; indelible pencil or wax marker; rod device or contour plotter

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Any radiotherapy patient; radiation therapy technologist; radiotherapist

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Preparing a contour drawing at the appropriate treatment level(s) of any patient to receive external beam radiation therapy by explaining to patient; checking positioning and immobilization of patient; measuring patient; using plaster of paris bandage, or wire, or rod or plotter devices to create the shape of the body; laying out anterior-posterior and/or lateral dimensions on paper; tracing contour outline on paper or connecting dots produced by contouring device; transferring patient markings to contour drawing; writing in patient's name; placing for use.

List Elements Fully

Performer constructs or prepares cross-section contour drawing(s) of patients who are to be treated with external beam radiation therapy during or after simulation and initial set-up so that a treatment plan can be calculated. Performer may make the contour as a result of request, as a regular assignment, or may decide to do while carrying out simulation or set-up.

1. Performer has or obtains the information needed to make the contour.
    a. Notes the proposed treatment technique, field arrangements, locations, and sizes. Reviews portal and localization films.
    b. Notes the beam angulation and patient positions prescribed.
    c. Notes the location of the tumor, field separation measurements.
    d. Notes the position(s) and level(s) at which the contour(s) are to be prepared.
    e. Performer notes what marks are to be used as guides for preparing the contour, such as tattoo or dye marks at the center of field or isocenter and side light marks (triangulation marks).
    f. Notes whether contours will be made with use of a mold of plaster of paris bandage, bending of lead wire or solder, rods mounted on a frame, or a plotter.

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6. Check here if this is a master sheet..(X)

TASK DESCRIPTION SHEET (continued)

Task Code No. 574

This is page 2 of 3 for this task.

List Elements Fully

g. Performer assembles the materials needed, depending on the equipment to be used at the given institution.

2. Performer joins the patient (where simulation or initial set-up may be underway) and any co-worker.

   a. Greets patient; introduces self; explains what will be done or has this done.
   b. Has patient placed in the treatment position for the first contour. May explain to patient that a contour of the whole body may be needed, with the patient assisted to turn over so that procedure can be repeated for the posterior half of the body.
   c. Performer checks the patient's position. If performer judges that this is not correct, may indicate this to co-worker and correct or have it corrected.

      i) Checks that patient has been properly and comfortably immobilized. May suggest removal, addition, or rearrangement of immobilization devices.
      ii) Checks that all reference marks are present.

3. If not already done, performer measures the anterior-posterior and/or the lateral thickness of the patient at the appropriate level(s). Uses calipers. May average the A-P dimension if patient is to be treated in more than one position. Records.

4. Performer draws a base line on transparent paper (or paper appropriate for the device to be used).

   a. Using a centimeter measuring scale or ruler, marks off the lateral cm. thickness of the patient on the horizontal line, and marks right and left sides as appropriate. (Treats

List Elements Fully

the horizontal line as representing the treatment table).

   b. May draw in a center vertical line and mark off the appropriate anterior-posterior distance to or at midline, as appropriate.

5. If the contour is to be obtained by molding plaster of paris or shaping lead wire or solder, performer may apply protective lubricant to patient's body to keep plaster of paris or solder material from irritating patient's skin. Makes sure patient markings are still visible.

   a. With plaster of paris bandage or splints, folds into narrow strips of appropriate layers of thickness.

      i) Moistens and squeezes between fingers. Lays strips at appropriate level of body, following the relevant patient markings. Covers half the patient's total circumference.
      ii) May mark anatomical landmarks, field information, triangulation points on the plaster bandage with a colored indelible pencil after the contour has hardened.
      iii) Removes contour after it has set and repeats for second half.

   b. With lead wire or solder, applies length of thick solder or wire by bending about the patient, following the patient markings as described.

      i) Marks anatomical landmarks, field information, triangulation points on the wire with a wax pencil.
      ii) Removes and repeats for second half.

TASK DESCRIPTION SHEET (continued)

Task Code No. 574

This is page 3 of 3 for this task.

List Elements Fully

c. Performer positions the shaped material on the prepared paper so that it corresponds to the lateral and/or the anterior-posterior measurements already laid out. Takes care not to distort the shape while handling contour.

   i) Holds the shape in place and, using a marking pencil, draws the prepared outline on the tracing paper from the inside shape of the plaster or wire.
   ii) Transfers the landmarks, field information and triangulation points onto the paper. May measure the dimensions on the patient and on the paper contour to check accuracy. Adjusts as appropriate.

d. Has any lubricant cleaned from patient's body.

6. If the contour is to be obtained by use of a set of rods mounted on a frame, performer arranges the moveable rods so that they are adjusted to given points on the skin surface to be duplicated.

   a. Performer transfers the frame shape to the paper within the line(s) laid out, and forms a series of dots on the paper as determined by the rod adjustments.
   b. Performer creates the contour by joining the dots.
   c. Marks appropriate field and anatomical parts as described.

7. If the contour is to be obtained by use of a plotter, performer sets up the apparatus with the paper placed vertically before the marker.

   a. Performer moves the pointer of the device across the plane of interest, and makes contact at 1 to 2 cm. distances, pressing the marker against the paper, thereby making a dot.
   b. Performer removes the apparatus when the entire surface to be studied has been outlined by dots.
   c. Performer creates the contour by joining the dots.
   d. Marks appropriate field and anatomical points as described.

8. If the patient is to be treated anteriorly and posteriorly (while reclining), attempts a complete cross-section with patient in one position if possible. If not possible, has patient repositioned and immobilized with the opposite aspect up, or returns when notified that the reverse field is being set up. Performer does the other half of the contour and then fits the two halves together.

9. If not already transferred to contour, performer measures the field areas, field separations and triangulation points on the patient's body. Lays these out on the contour and marks.

   a. Performer may indicate the areas to be shielded or blocked. Measures these from patient markings if not already transferred, and lays out on drawing.
   b. Performer may write in figures on tumor depth and volume on contour drawing. If appropriate, performer records beam angulation for fields entered at oblique angles; may transfer entry points and angles if not already done.

10. Performer writes patient's name on the contour drawing and any other appropriate information.

11. Performer gives the contour drawing to the proper staff person or places it for further use, as appropriate.

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
Code 575 This is page 1 of 2 for this task.

Performer's Name ____________ Analyst(s) ____________ Dept. ________
Job Title ____________ Institution ____________ Date ________

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Requisition reviewed; patient reassured; transverse axial tomography equipment set up; film identified; technical factors, level, angle, depth (opening), and speed selected and set; patient positioned; tomograms taken, sent for processing; procedures repeated as ordered; patient returned; examination recorded; cross-section tomograms placed for use.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt.'s requisition sheet, ID card, ID bracelet, medical and technical history or simulation sheet; view boxes; pen, paper; x-ray generator; transverse axial tomography unit, table, control panel, tube, collimator; technique, cooling, tube rating, and rad exposure charts; cassettes; immobilization devices; lead shielding; R-L, level and ID markers; centimeter scale; calipers; wax marker; intercom; stretcher; wheelchair

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Any patient; radiotherapist; co-worker; accompanying staff member

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Taking transverse axial tomograms of any patient by reviewing request; preparing equipment; reassuring pt.; positioning pt., table and equipment for selected cross-section level; setting TFD, filter unit angle, opening (depth), and speed, technical factors; providing shielding; identifying and placing cassette; checking rotation; making cross-section tomogram exposure(s); arranging for processing; having pt. returned; placing cross-section tomograms for use; recording examination.

List Elements

Performer receives or obtains the requisition form, patient identification information, portal films and/or simulation sheet for a patient scheduled for transverse axial tomography (cross-section radiographs) to determine the thickness of tissue, depth of organs, or to localize organs or tumor for treatment planning, as a result of:

a. Regular assignment.
b. Request.
c. Decision to do during simulation or set-up procedures.

1. Performer reads relevant information to determine the necessary information about the patient, how to position, the level(s) at which the transverse tomogram(s) are to be taken, location of reference points marked on patient, such as painted or tattooed markings at the level(s) involved (such as center of field(s), isocenter, anatomical reference points), patient dimensions, and any special considerations.

2. Prepares equipment ahead:
   a. Checks power supply.
   b. Based on patient's size and the area of interest, selects correct focal spot size; mounts wedge grid; selects film and cassette of appropriate size; and/or has cassette loaded with film. Identifies cassette.

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6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 2 of 2 for this task.

Code 575

Performer's Name________________ Analyst(s)________________ Dept.__________
Job Title________________ Institution________________ Date__________

List Elements

c. May prepare table and add support if needed based on the expected orientation of the patient on the table.

3. Greets patient; checks identity; explains what will happen; reassures.

   a. Checks that patient markings are present.
   b. May measure cross-section dimensions of patient at the level(s) of interest.

4. Positions patient in supine or prone position as appropriate on table. Sets equipment for the first tomogram.

   a. Positions patient on table in appropriate head-foot orientation for area of interest. Centers to midline.
   b. Adjusts lateral position of table to start position.
   c. Immobilizes patient.
   d. May place right or left marker.
   e. Shields gonads or other areas as appropriate.
   f. Adjusts table longitudinally so that light system shows that gantry is centered to the cross-section level of the patient to be radiographed. Checks that light falls on patient's skin at appropriate marked point.
   g. Sets moving filter unit as appropriate to the shape, size and position of the patient at the level of interest. Checks charts for equipment if needed.

      i) Determines and sets the angle setting as ordered or appropriate (for the area of interest and size).
      ii) Determines and sets the filter openings for the depth to be covered by filters based on position, size, and shape of area of interest. Uses chart.

List Elements

      iii) Sets speed setting based on the angle setting and opening setting. May use chart.

   h. Sets and checks appropriate source-to-film distance based on the degree of magnification required or standard orders.

5. Without making exposure, rotates support arm and checks that x-ray tube, collimator and grid holder will not collide with patient and any other equipment when the tomogram is being exposed. Adjusts as needed.

6. Sets exposure factors based on patient's size, area of interest. Uses automatic exposure control or sets manually, as appropriate, for kVp, mA and time. Checks that settings are within safe limits of tube capacity.

7. Instructs patient on holding still. Checks that equipment is ready.

8. Makes exposure as appropriate, keeping pressure on both control switches until timer indicates end of sweep.

9. Removes cassette.

10. Repeats for other tomograms.

11. Has tomograms processed. May review and/or repeat if necessary.

12. Assists patient to leave and to next location or has this done.

13. Records. Places tomograms for use. May inform co-worker that cross-section tomography is completed.

Note: This task may be done by a radiologic technologist rather than a radiation therapy technologist, depending on training and licensure considerations.

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
This is page 1 of 2 for this task.

Code 576

Performer's Name ____________ Analyst(s) ____________ Dept. ________
Job Title ____________ Institution ____________ Date ________

1. **What is the output of this task?** (Be sure this is broad enough to be repeatable.)

Simulation or external beam radiation equipment set up as ordered; pt. positioned as ordered; fields, centering points marked or laid out as ordered;film identified and positioned for portal films; pt. measured; technical factors set for portal films as ordered.

2. **What is used in performing this task?** (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Simulator or external beam treatment machine, controls;fluoroscope;distance,beam angle indicators; table;light system;collimator;beam accessory holder; blocking tray;cones,applicators;scales,rulers;x-ray film,holders,cassettes;cassette holder;wax markers; immobilization devices;radiopaque cross,markers, strips,ID markers;beam blocks;beam direction device, pin and arc,back pointer,side lights;plastic plate, metal grid;tape,scissors;dye,ink,sticks;pen,pencil; stretcher,wheelchair;procedure tray;support stand; soap,water;calipers;technique charts

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. **If "Yes" to q. 3:** Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Any radiotherapy patient to have external beam therapy;radiotherapist;radiation therapy technologist; physicist;nurse;family member

5. **Name the task** so that the answers to questions 1-4 are reflected. Underline essential words.

Assisting as ordered with localization,simulation and/or initial set-up procedures for any patient to receive external beam radiation therapy,using simulator or treatment machine as ordered,by positioning, immobilizing pt. as ordered;helping to position equipment,accessories as ordered;measuring pt.;setting technical factors;placing cassette;placing radiopaque markers;outlining field;handling materials, as ordered;reassuring patient.

List Elements

Performer assists with localization, simulation and/or initial set-up procedures for patients scheduled for external beam radiation therapy as ordered.

1. Performer is with or joins the patient and the radiotherapist (or the radiation therapy technologist) in the treatment or simulator room, and assists as ordered. Greets patient as appropriate.

2. Performer may carry out any or all of the following:
   a. May assist patient to table and position on table in treatment position as ordered.
   b. May apply immobilization devices.
   c. May set or check source-to-skin distance or isocenter source-to-axis distance as ordered. May position stretcher or treatment couch.
   d. May prepare accessories such as cross, grid, grid plate, beam blocks on accessory tray at correct distance as ordered.
   e. May identify x-ray film in cassette or holder, place cassette in cassette tunnel or holder.
   f. May adjust a centimeter scale for the prescribed SSD and insert it into the beam column.
   g. May measure the patient in order to select exposure factors. May use centime-

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6. Check here if this is a master sheet..(x)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 2 of 2 for this task.

Code 576

Performer's Name________________ **Analyst(s)**________________ **Dept.**________
Job Title________________ **Institution**________________ **Date**________

List Elements	List Elements
ter calipers to measure the thickness of the area to be radiographed in the indicated direction in which the central ray of the x-ray beam (or treatment beam) will pass through the centered part from tube to film. h. May select and set the exposure factors for the first projection by consulting the technique chart(s) posted for the machine to be used or as ordered. May set up for diagnostic radiograph, for gamma ray beam film, and/or for fluoroscopy as appropriate. i. Places radiopaque markers or strips as indicated on collimated light area, at marked center of field, at corners, along perimeter of field, or as otherwise ordered. j. May measure patient's anterior-posterior or other dimensions, field sizes, or other distances on the patient's body as ordered. Uses centimeter calipers or flexible ruler to measure, as appropriate. May record measurements if so requested. k. May draw in outlines (on patient's body) of field areas and/or areas to be shielded by referring to designated surface boundaries, collimated light beam, lead strips, and/or patient markings. May also mark designated points on body. Uses a prepared vegetable dye solution and applies markings with a stick. Traces outline or connects markings. When so ordered, removes lead strips; washes off unwanted markings. l. May assist by handing materials as needed, checking sizes of accessories. m. May reassure patient.	

TASK CODE	EXTENDED TASK NAME
577	Applying lead contact or spatula-type internal eye shield under any radiotherapy patient's eyelid by reviewing what is required; assembling materials; explaining to patient and positioning; having eye anesthetized; checking shield for rough edges; sterilizing, lubricating shield; inserting shield under lid using sterile technique; notifying co-worker when completed.[a]
578	Inserting radiopaque probe into female patient's vagina to localize tumor or cervix, by reviewing what is required; assembling materials; explaining to patient and positioning; having vulva and perineal area cleansed; lubricating probe; inserting into vagina as appropriate to level of obstruction or cervix; notifying co-worker when completed.[a]
579	Inserting balloon catheter or barium enema in any patient's rectum to localize tumor or rectum by reviewing what is required; assembling and positioning materials; checking enema kit or balloon catheter; explaining to patient and positioning; applying local anesthetic if needed; expelling air, inserting enema tip or inserting balloon catheter; inflating balloon with barium mixture or water, and/or air, or allowing enema to flow; clamping when done; notifying co-worker.[a]
580	Taking photograph(s) of any patient's face and/or treatment areas as ordered by reviewing request; loading camera (Polaroid); explaining to patient; positioning; focusing; making exposure(s); waiting for processing; checking photograph(s); identifying and dating photograph(s); placing to have print coater applied, or placing for use or in patient's chart, as appropriate.

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[a] Note that tasks 577, 578 and 579 may be done by a physician, depending on institutional or legal considerations and the training of the personnel involved.

TASK DESCRIPTION SHEET

Task Code No. 581

This is page 1 of 5 for this task.

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Questions answered and/or planning and arrangements made on type of treatment device(s) to be fabricated, such as shell, mold, cast, applicator, beam block, shields, bolus; materials and methods selected; information recorded, placed for scheduling.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Patient's medical chart or relevant medical information, diagnostic radiographs; proposed treatment technique; paper, pen or pencil; appropriate requisition sheets or forms; view boxes; information on mold room equipment and materials

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Radiotherapist; physicist; radiation therapy technologist

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Discussing, planning and arranging for mold room procedures to fabricate treatment devices such as shells, casts, masks, applicators, beam blocks, bolus, shields, etc., for use in radiation therapy by discussing, volunteering information and/or responding to questions; reviewing proposed treatment plan, modality, field arrangement, nature of tumor, patient's condition, type of device, materials, method of fabrication needed, and appropriate sequence of events; selecting or suggesting appropriate devices, materials and methods of fabrication; arranging for scheduling, or placing information for scheduling.

List Elements Fully

Performer plans and/or provides information about treatment molds, casts, shells, masks, cut-outs, beam blocks, bolus, or immobilization devices to be custom fabricated for a patient to receive radiation therapy, after receiving the proposed treatment technique, related medical information, and/or requisition forms from the radiotherapist or a co-worker, or provides information based on experience with mold room materials and equipment during formal or impromptu conferences or discussions on the feasibility of a proposed or revised treatment plan, or answers questions, or checks aspects of such plans when called on.

1. Performer reads, reviews, asks about, and/or discusses the proposed treatment technique and notes the relevant information in order to consider the treatment devices requested or required and to plan for fabrication.

   a. Performer notes the patient involved, the condition, and the area to be treated.

      i) Notes the patient's name, identification number, sex, height, weight and age.
      ii) Notes the name of the radiotherapist in charge.
      iii) Notes whether patient is a new patient for

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6. Check here if this is a master sheet..(X)

TASK DESCRIPTION SHEET (continued)

Task Code No. 581

This is page 2 of 5 for this task.

List Elements Fully

whom treatment is to be planned, or current patient whose treatment plan is to be modified. Notes whether patient is in-patient, out-patient, to be treated as emergency patient.

b. Performer reviews and/or discusses the patient's diagnostic material indicating the nature of the tumor, its estimated location, size, and volume.

  i) Notes whether the treatment is for radical curative or palliative purposes, whether the disease is considered terminal.
  ii) Notes the radiation modality suggested, such as external beam, surface, and/or intracavitary radiation therapy, whether the therapy is to be done in conjunction with other modalities such as surgery, interstitial radiation, and/or chemotherapy. Notes whether radiation therapy is pre-operative, post-operative. If post-operative, checks whether patient is sufficiently healed for fabrication steps to be carried out.
  iii) Notes or discusses whether the tumor is in close proximity to healthy, radiosensitive tissues.
  iv) Considers whether the patient must be confined to stretcher for treatment.
  v) Notes whether patient may require prior sedation, immobilization. Notes whether patient is ambulatory, will be in a wheelchair or on a stretcher.

c. Performer notes whether sufficient information is available to plan for fabrication procedures. If any records are missing, arranges to have them sent. May review radiographs of tumor on view boxes.

List Elements Fully

d. For external beam radiation therapy, notes the machine and type of field arrangement selected:

  i) Notes the type of machine and energy level selected for the treatment such as a superficial x-ray machine, orthovoltage or conventional x-ray machine; megavoltage (supervoltage) equipment, such as betatron or linear accelerator (and choice of x-ray or electron beam), or teletherapy machine using radioactive isotopes as gamma ray source, such as cobalt-60 or cesium-137, or combination, depending on the equipment available.
  ii) Notes the recommended field locations and arrangements for the treatment (whether stationary, such as single direct field(s), parallel opposed pair(s), moving strip fields, wedge-pairs, multiple converging fields; or moving fields, such as arc or rotation). Notes the need for devices to direct or affect beam quality or shape and/or special shielding required.

e. For surface, intraoral or intracavitary radiation therapy, notes the type of applicator required, the proposed arrangement of the radioactive source, the type of source to be used, and the size, shape, and location of the treatment area.

f. Considers whether the age and condition of the patient and the type of tumor require special nursing services during patient's presence in the mold fabrication unit. Notes whether dressings will have to be removed, surfaces cleansed, and dressings replaced. Considers the extent to which the patient may be moved or

TASK DESCRIPTION SHEET (continued)

Task Code No. 581

This is page 3 of 5 for this task.

List Elements Fully

is obstructed by infirmity, catheters, IV apparatus, or similar life support devices.

2. Performer considers the type of devices to be fabricated and the purpose(s) in relation to the proposed treatment technique, treatment machine, patient positions, and field arrangements suggested.

   a. Notes whether beam directing shell, cast or mold will be required, whether device will act as field localizer (with field area cut out or marked on surface), whether device will include seating for beam column. Notes whether device will be used to immobilize patient, whether device will be attached to angle board, to examination table, chair and/or head rest or holder.
   b. Notes whether a mold is ordered as an applicator, such as for intraoral external beam or sealed source radiation, intracavitary and implant radiation (such as for vagina), for superficial radiation.
   c. Notes whether custom-made lead mask or cut-outs are ordered for radiation protection, whether intraoral blocks, stents or other protection is needed.
   d. Notes whether beam blocks, bolus, and/or tissue compensators are to be fabricated.
   e. Notes whether positioning or beam alignment jigs or other immobilization devices are to be fabricated.
   f. Performer considers the type of device requested, the suggested materials from which the devices are to be made, the equipment and method to be used in relation to the treatment modality, patient position, field arrangement, the qualities of the materials suggested, and the time and steps needed to fabricate the devices.

List Elements Fully

   g. Considers whether the device(s) selected are appropriate for the proposed treatment technique.
   h. Considers whether the materials suggested and methods to be used for fabrication are appropriate for the purposes, treatment modality, equipment, patient condition and time limitations involved.

3. Performer may respond to questions or volunteer information on the feasibility of the proposed plan based on own knowledge of the materials and equipment available and personal experience; may discuss with radiotherapist, physicist or radiation therapy technologist.

   a. May indicate capabilities of equipment and materials for fabrication of the devices, the characteristics in relation to treatment modality, use over time, mobility of patient.
   b. May suggest alternative devices, materials, methods of fabrication or treatment position(s).
   c. May recommend materials, methods, type of device, or patient position.
   d. Discusses as appropriate. Draws on performer's prior experience and knowledge of the properties of the materials, current literature in the field.
   e. May receive modified treatment proposal. May make notes during discussions recording information needed to carry out fabrication of the devices. May have new requisition signed.

4. Once the type of device(s) to be fabricated are agreed upon and recorded, performer may record final decisions on the materials and methods to be used, procedures, and sequences.

TASK DESCRIPTION SHEET (continued)

Task Code No. 581

This is page 4 of 5 for this task.

List Elements Fully

a. Performer considers whether the direct or indirect method will be used in preparation of shells, whether of plaster, plastic, lead. Notes appropriate sequence of events.

b. Performer considers appropriate sequence:

   i) Considers what must be fabricated and available for use in any simulation and/or initial set-up to be scheduled.
   ii) Considers what must be done during or directly after simulation and/or initial set-up.
   iii) Considers at what stage the patient must be present and what steps can be done without presence of patient.
   iv) Considers staff required during fabrication, such as for administration of local anesthetic, medication, sedation, patient positioning, nursing care; considers any need for an interpreter.
   v) Plans for simulation or set-up recheck of the device on the patient after fabrication and before actual use in treatment.

c. For shell, cast, mold, or mask, performer considers the best approach, such as the number of pieces, the parting lines, the direction of removal of pieces to avoid "undercuts" (arrangement that would prevent free removal of the negative impression from which the positive shell, cast, mask or mold is to be made).

   i) Notes or determines the location of the maximum contour line in relation to the surface on which the patient will be lying or resting. Considers the part of the body involved.
   ii) Decides on the number of pieces, parting lines, direction of removal, type of joints for reassembling the parts.
   iii) Plans sequence in which the device will be made.

d. Takes account of time required for various procedures, the personnel required, and the need to have radiotherapist, radiation therapy technologist, or physicist available to approve materials, contours and/or films produced.

e. Arranges to schedule fabrication procedures as appropriate. Makes sure proper staff are requested for nursing functions and/or for other support.

5. Performer writes out or may orally communicate instructions for the procedures including design specifications (if appropriate) for the fabrication of the treatment device(s); includes information on the proposed treatment plan, the need for special services or personnel, scheduling of the patient, and any other relevant information.

   a. Orders may include fabrication of a treatment shell or applicator of plaster of Paris bandages using the direct technique, fabrication of a lucite or acrylic treatment shell, mold, mask or cast with indirect technique using dental impression compound (such as alginate) reinforced with plaster of Paris bandage, resin acrylic, plaster of Paris, or stone plaster, a vacuum forming machine to make the shell, or beaten lead to make mask. Orders may include fabrication of applicators to hold radioactive sources, stents, bite blocks, bolus, lead cut-outs, internal eye shield, beam blocks, compensating filters, cutting out treatment portals in

TASK DESCRIPTION SHEET (continued)

Task Code No. 581

This is page 5 of 5 for this task.

List Elements Fully	List Elements Fully
shell, mask, and fitting treatment shell to patient. b. Performer may specify the proportions of the materials to be used for cast based on the surface area to be covered and the time available before the mixture hardens. c. Gives information and orders to appropriate co-worker, or sets aside for own use, as appropriate. d. If appropriate, expedites scheduling for emergency patient. e. May inform or report to appropriate staff member when initial scheduling has been planned.	

TASK DESCRIPTION SHEET

Task Code No. 582

This is page 1 of 7 for this task.

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Radiotherapy treatment shell fabricated on patient with direct, plaster of Paris bandage wrapping technique; pieces separated, removed, reassembled and placed for final drying; patient's return arranged; record entered.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt.'s proposed treatment plan,requisition sheet, ID card,bracelet,medical-technical chart;fast setting resin plaster of Paris bandages;water and basin; clean-up supplies;work bench;lead strips;rubber bathing cap;plastic wrap;lubricating jelly,oil,Vaseline; sterile gauze;tape;cutting tool; tubegauze and applicator;paraffin gauze,butter muslin;separating medium; dental head rest;head support;immobilization devices; angle board;treatment table or chair;stretcher,wheelchair;breathing straws;clamps;infrared lamp; marking pen;calipers;protractor;spatulas

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Mold room technology supervisor;any radiotherapy pt.; accompanying staff or family member;radiation therapy technologist;radiotherapist;physicist;co-worker

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Fabricating a treatment shell or mask of plaster of Paris bandages using direct technique for radiotherapy pt.,by reviewing orders; preparing supplies; reassuring,explaining to pt.;applying lubricating medium,lead separation strips;wetting and wrapping plaster of Paris bandages;allowing to set;cutting shell apart and/or removing shell;reassembling shell pieces;identifying and placing for dry-out;arranging for patient to return;recording.

List Elements Fully

Performer fabricates a treatment shell or mask of plaster of Paris bandages using the direct technique on a radiotherapy patient(for use in immobilizing the patient, to provide precise beam orientation, a seating for bolus or beam applicator or lead shielding, to localize treatment fields, and/or for use in treatment planning).

1. Depending on institutional procedures, performer receives or obtains the appropriate mold room requisition form, the patient's identification card, the proposed treatment technique, related medical information, and specific instructions on the area(s) to be covered by the shell, the number of pieces, the parting lines (if any), the direction of removal, or is referred to standard procedures.

2. Performer reads the requisition sheet to determine what is called for, the patient involved, his or her condition, the area to be covered by shell, the purpose, any special considerations, and to check the completeness of the information provided:

   a. Performer notes the patient involved, the condition, and the area to be covered by the shell.

      1) Notes the patient's name, identification number, sex, height, weight and age.

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

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This is page 2 of 7 for this task.

List Elements Fully

ii) Notes the name of the radiotherapist in charge, the physicist and/or radiation therapy technologist involved.

iii) Notes whether patient is in-patient, out-patient, to be treated as emergency patient.

iv) Notes the nature and location of the tumor and the areas to be covered by the treatment shell. Notes the recommended field locations, arrangements for the treatment and dimensions of portals.

v) Notes the suggested position of patient for each treatment field, such as supine, lying on side, prone, erect in chair provided with head support.

b. Performer notes any special considerations that may affect the positioning or handling of the patient.

i) Checks whether patient mobility is restricted and will interfere with the planned positioning of patient during fabrication. If so, may plan for alternative positioning or may report and/or suggest alternative positioning to the physician in charge.

ii) Checks whether patient is suffering from a collateral condition requiring special attention in handling, such as heart disease, communicable or infectious condition, infirmity, incoherence, behavioral disorder.

iii) Notes whether trachea tube must be protected, whether patient will require breathing straws, whether for nostrils and/or mouth.

iv) Checks whether patient such as epileptic must be fitted on a ground-level stretcher to protect patient from accident.

v) Notes whether patient will have IV drip, oxygen supply, urinary catheter, colostomy, T-tube, or similar device attached, interferring with the patient's mobility.

vi) Notes whether patient will be arriving on stretcher, wheelchair, will be accompanied by nurse, other staff, or family member.

vii) Considers whether the age and condition of the patient and the type of tumor require special medication or nursing services. Notes whether dressings will have to be removed, surfaces cleansed, and/or dressings replaced.

viii) Considers whether the patient's psychological state must be considered to ensure proper attention to the patient.

ix) Considers whether the patient requires the services of an interpreter.

x) Performer may note whether orders for prior nursing preparations have been given and carried out; if not already done, may arrange to have orders carried out or informs appropriate staff member. If patient's record indicates orders for sedation or any other prior medication, performer may check timing to be sure a proper elapse of time has occurred for medication to take effect. May arrange to delay procedure if appropriate.

xi) May note pediatric patient's feeding schedule and arrange to have patient fed while in department if not contrary to needs of procedure.

c. Performer notes any other procedures to be carried out in parallel with or subsequent to preparation of the shell:

TASK DESCRIPTION SHEET (continued)

Task Code No. 582

This is page 3 of 7 for this task.

List Elements Fully

i) Notes whether shell will be attached to angle board, head holder, will provide seating for external beam cone or applicator, will serve as applicator for sealed radioactive source (for surface application), whether portals and other markings will be transferred to finished shell during simulation, whether portals will be marked during simulation procedure and cut out of the shell after simulation (and rechecked).

ii) Notes whether dental head rest will be incorporated into shell.

iii) Notes whether a bolus will be attached to shell after fabrication, whether shell will be used for treatment planning and fitted with devices to aid dosimetry.

iv) Notes when the shell is required for simulation and/or initial set-up verification.

d. Performer reviews the patient position to be used for the molding of the shell, the number of pieces, parting lines (if any), and the direction of removal of pieces. Checks whether these are appropriate. Checks that the impression is planned to the maximum contour line (unless a sprung removal will be accomplished easily).

e. Performer makes sure that the request is properly authorized, that the information needed is complete.

i) If the performer determines that the request is not properly authorized, is incomplete, inappropriate, or that sufficient information is lacking for performer to carry out shell fabrication, performer notifies supervisor, radiotherapist, physicist or other designated staff person, depending on institutional procedures.

List Elements Fully

ii) If performer has any questions about the proposed fabrication technique, discusses with appropriate staff person.

iii) Proceeds after obtaining needed information, signature, or orders.

3. When performer is clear about what will be involved, he or she prepares ahead so as not to keep the patient in the fabrication room longer than necessary:

a. Performer checks that the proper materials are present. Washes hands as appropriate.

b. Places materials and instruments within easy reach of where patient will be positioned so that area to be covered is nearest work area.

c. Prepares the plaster of Paris bandages in strips of the appropriate width, length, thickness of layers. Lays out according to the areas to which they will be applied in the order in which they will be applied.

d. Makes sure that water (of correct temperature), bowl, covering for patient's skin (such as tubegauze, rubber bathing cap, paraffin gauze, butter muslin, or Vaseline) and separating medium for lapped pieces are available, and lead strips to be used in preparation for cutting apart pieces, and cutting tool. If appropriate, obtains dental head rest, angle board.

e. Makes sure that there is space available for placing the shell after removal from patient.

4. Performer readies the patient for the fabrication of the shell:

a. Performer has the patient brought from the holding area and prepared

TASK DESCRIPTION SHEET (continued)

Task Code No. 582

This is page 4 of 7 for this task.

List Elements Fully

for the procedure (if not already done), or decides to do personally. Depending on institutional arrangements, performer may decide to assist in bringing patient to the room.

b. Performer greets patient and any accompanying staff person and/or family member and introduces self. Checks patient's identity against the requisition sheet. With in-patient, checks hospital identification bracelet or other identifier. Checks with any accompanying staff member on any special precautions necessary during procedure.

c. Performer makes patient comfortable on the couch, table, or chair, or as appropriate to the type of treatment and position planned.

   i) If appropriate, works with patient on stretcher at ground level (if required for safety of patient, such as epileptic).
   ii) If patient is in wheelchair, may move patient in chair into position next to table. Makes sure that wheelchair is in locked position.
   iii) Performer may decide to assist patient into position or has this done. May obtain help. May raise or lower table.
   iv) May have nurse carefully place young patient on table, or lifts patient carefully and places on table.
   v) If patient has a life support system in place, such as respiration, cardiac or infusion equipment, makes sure that this is being monitored.
   vi) If there is a wet dressing, performer has it reinforced or decides to do personally.
   vii) Makes sure patient is being attended and there is no danger patient will fall off table.

List Elements Fully

d. Performer carefully explains to patient and/or family member the purpose of the shell fabrication procedures and what to expect. Uses language appropriate to patient's level of comprehension.

   i) Attempts to establish a supportive relationship with the patient while preparing for the procedures. If necessary, may converse through interpreter.
   ii) If appropriate, explains how much of the patient will be covered, such as entire head and neck.
   iii) Explains to patient and/or family member what steps will be carried out, what positions patient will be in, what will be used, what cooperation will be asked of patient.
   iv) Explains how patient can help by remaining perfectly still during period the material is "setting."
   v) Performer exercises care in reassuring patient while treating patient with dignity and compassion, bearing in mind that patient is suffering from a malignant disease that may be terminal, or with uncertain or poor prognosis. Without being blandly optimistic, performer tries to put patient at ease.
   vi) Considers the patient's psychological state, noting that the diagnosis may have been recent. Notes that patient may be frightened, emotionally disturbed, subject to behavioral disorders, may be incoherent, depressed, withdrawn, bitter, or hostile. Performer attempts to exercise consideration, respect, understanding, and as much warmth as possible. Treats patient with dig-

TASK DESCRIPTION SHEET (continued)

Task Code No. 582

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List Elements Fully

nity and concern regardless of patient's behavior

vii) Performer is careful to be supportive of the patient with respect to the patient's self-concept, body image and acceptance of the situation that there is a disease condition to be treated or palliated.

viii) If performer notes any unusual behavior or physical indication, or if patient is in an unusually agitated state or in great pain, performer may notify radiotherapist without alarming patient.

ix) If sedative, analgesic, or other medication is prescribed, performer proceeds as appropriate, allowing time for medication to take effect.

x) Performer answers patient's or family member's non-medical questions honestly; attempts to reassure patient and develop confidence. If questioned about medical prognosis, performer refers patient to his or her attending radiotherapist and indicates that refusal is result of ethical considerations rather than unwillingness to deal with patient. Performer does not lie or invent information.

e. Performer prepares patient as appropriate for the area to be covered:

i) May mark out the boundaries of the area(s) to be covered by the plaster.

ii) If patient's entire face will be covered, performer may determine whether the patient is a nose or mouth breather and insert breathing straws in nostrils, or place a breathing straw in the mouth, at an appropriate point in the procedure.

List Elements Fully

iii) If patient has a tracheostomy tube in place or similar device that lies in the area of interest, performer covers with sterile gauze and secures so that the passage will be kept clear.

f. If appropriate, adjusts dental head rest to a comfortable height.

g. Measures patient between indicated anatomical points using calipers. Records for use in adjusting the dimensions of the shell.

h. Performer first applies protection to the areas to be covered by the plaster:

i) For the head and hairy surfaces, may apply a rubber cap to head, cover with thin plastic wrap, or apply Vaseline or paraffin gauze.

ii) May apply tubegauze with applicator as appropriate to cover face and head. Applies as many layers as appropriate. Twists, cuts and secures ends with tape. Cuts away face area if appropriate. Ties and secures in place with tape.

iii) Applies a light covering of oil to skin areas.

i. Performer adjusts patient in the treatment position, such as seated in chair, supine on table.

i) Adjusts head angulation if appropriate, in relation to the vertical and horizontal planes, using anatomical reference lines as appropriate.

ii) May use neck support, head holder, soft wedges, angled head or body boards.

iii) May use immobilization devices to hold patient in position.

iv) Secures dental head rest if appropriate.

TASK DESCRIPTION SHEET (continued)

Task Code No. 582

This is page 6 of 7 for this task.

List Elements Fully

j. If the shell will be cut apart later for removal, performer molds a lead strip along each planned separation line (to protect patient when cutting is done). Extends strip well beyond area to be wrapped. Tapes into place.

k. Lubricates all surfaces with medium such as Vaseline, covering bathing cap, lead strip, heavy hair areas such as eyebrows. Smooths down all visible hair against skin.

5. Performer applies the prepared plaster of Paris bandage strips in a predetermined sequence:

   a. For each strip, dips the plaster bandage roll in water and applies.

      i) Incorporates the dental head rest and/or angle board if appropriate.
      ii) Does not squeeze out excess fluid from roll.
      iii) Wraps bandage rapidly as many times around area as required.
      iv) Strokes wrappings with moistened fingers and palms to press out air and create a smooth and firm finish.
      v) Continues wrapping until entire area to be covered has been wrapped. Smooths all trapped air away with fingers.

   b. Applies finishing strips with cuffs as appropriate.

      i) For finishing strips, presses water from strips by squeezing between index and middle finger. Smooths out air.
      ii) Turns under edge of finishing strip(s) to form cuff.

   c. If appropriate, performer applies plaster sequentially to separate sections.

List Elements Fully

      i) Allows each section to harden separately.
      ii) Applies a separating (grease) medium on the plaster where the next section is to be overlapped.

   d. Performer wipes away all splashes from the plaster bandage application and cleans bowl before liquid hardens, or has this done.

6. Performer asks patient to remain immobile to allow the shell to harden for the initial "set."

7. After appropriate period, performer cuts the shell along the separation lines where the lead strips were placed. Uses appropriate knife or cutting tool.

8. Performer removes the shell piece(s) in the appropriate directions to avoid "undercuts," or springs the shell apart in the appropriate direction. Eases forward from the patient's body.

9. Performer may remove the anterior portion (such as with cranial cap) and allow to dry separately on flat surface, or reassembles the pieces of the shell again at once.

   a. If reassembling, holds parts together with clamps or other fastener. Applies plaster strips to all joined edges.
   b. Uses calipers and compares the measurements originally taken of the patient with the dimensions of the mold assembly. Adjusts as appropriate to the true interplane distances.
   c. Attaches identification information as appropriate.

TASK DESCRIPTION SHEET (continued)

Task Code No. 582

This is page 7 of 7 for this task.

List Elements Fully	List Elements Fully
d. Sets shell aside to dry overnight or applies infrared lamp by setting for appropriate period of hours.	
10. Performer explains to patient or attendant when he or she is to return (when unit is completely dry) if appropriate for next stage of treatment planning or simulation.	
a. Notes scheduling already done or arranges to have patient scheduled.	
b. Performer notes where patient is scheduled to go next. Notes whether patient is to go home, back to room, or to any other scheduled location.	
i) If appropriate, makes sure that designated staff person is there to bring patient to appropriate next location.	
ii) May decide to assist patient to leave; may decide to transport personally; or may have this done.	
11. May record what was done as appropriate. May indicate to appropriate staff person when the performer is ready to proceed with next fabrication.	

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
This is page 1 of 5 for this task.

Code 583

Performer's Name ____________ Analyst(s) ____________ Dept. ________
Job Title ____________ Institution ____________ Date ________

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Radiotherapy treatment mold or cast fabricated with indirect technique; impression made on patient with alginate, reinforced with plaster of Paris bandage; pieces separated, removed, reassembled; pt.'s return arranged; cast or mold mixture of plaster of Paris, liquid resin acrylic, or stone plaster poured; mold or cast set aside to harden; record entered.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt.'s proposed treatment plan, requisition sheet, ID card, bracelet, medical-technical chart; fast setting resin plaster of Paris bandages; water and basin; bathing cap; plastic wrap; lubricating jelly, oil, Vaseline; sterile gauze; tape; cutting tool; tubegauze and applicator; paraffin gauze, butter muslin; separating medium; dental head rest; head support; immobilization devices; angle board; treatment table or chair; stretcher, wheelchair; breathing straws: clamps; infrared lamps; marking pen; calipers; protractor; alginate impression materials; mixing bowls; measures; spatulas; tubing; ear plugs; internal eye shield; eye lubricant; applicator removal stem; release agent; soap, water, towels; containers; plaster of Paris, resin acrylic dental material or stone plaster materials; oven; temperature and timer controls; drill; antiseptic and sterile eye solutions; swabs; eye pad; box mold

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved.

Mold room technology supervisor; any radiotherapy pt.; accompanying staff or family member; radiation therapy technologist; radiotherapist; physicist; co-worker

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Fabricating a treatment mold or applicator or solid cast for radiotherapy pt. from dental impression compound, and/or plaster of Paris, or liquid resin acrylic, or stone plaster using indirect technique by reviewing orders; preparing supplies; reassuring, explaining to pt.; making alginate impression; reinforcing with plaster of Paris bandage; allowing to set; removing; cleaning pt. and arranging for return; reassembling, reinforcing, sealing mold; mixing cast or applicator materials; pouring into or on mold; identifying and placing for drying out; recording.

List Elements

Performer fabricates a radiotherapy mold, or applicator, or a solid cast to be used in the fabrication of a treatment shell, applicator, lead cut-out mask, or for treatment planning, using the indirect technique and a dental impression compound (reinforced with plaster of Paris), liquid resin acrylic, or stone plaster.

1. Depending on institutional procedures, performer receives or obtains the appropriate mold room requisition form, the patient's identification card, proposed treatment technique, related medical information, and specific instructions on the areas to be covered by the shell or mask, the type of mold for sealed source application (whether for superficial or intracavitary use and the location), the number of pieces for mold or shell, the parting lines (if any), the direction of removal of the pieces.
    a. Performer notes the purpose of the final treatment shell, mask, cast, or mold, such as a shell for immobilizing the patient, to provide precise beam orientation, as a seating for bolus, beam applicator, to localize treatment fields, a lead mask to shield and define portals, a solid cast for use in treatment planning, for

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6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 2 of 5 for this task.

Code 583

Performer's Name________________ Analyst(s)________________ Dept.________
Job Title________________ Institution________________ Date________

List Elements

use in preparation of the shell, as a model on which lead shielding will be shaped, a mold applicator to carry a sealed source for superficial or intraoral radiation, or a vaginal mold to carry a sealed source for intracavitary radiation.

b. Performer notes the steps involved and materials:

   i) May plan for later preparation of a clear lucite (plexiglass, perspex) shell or mold after making an impression shell of dental impression compound (such as alginate), reinforced with plaster of Paris bandage, followed by preparation of a cast of plaster of Paris or stone plaster.

   ii) May plan for later preparation of a lead cut-out mask.

   iii) May plan for later preparation of a one or two-part plastic, acrylic or lucite surface applicator that will have grooves or channels and tubes for loading of radioactive sealed source.

   iv) May plan for preparation of a vaginal mold to be used for intracavitary application of a radioactive sealed source (in conjunction with a remote afterloader).

   v) May plan to prepare a solid cast for use in treatment planning, to be used as a model on which to shape lead shielding, or on which to fit other devices to the patient's contours.

2. This task incorporates the initial steps of Task Code 582 except as follows:

   a. General initial steps include finding out what is being requested, who is involved, proposed treatment plan, condition of patient, purpose, and detailed instructions on method and materials for preparation of shell, mold, cast or applicator, outputs required, and any later procedures to follow or plan ahead for.

   b. Prepares ahead for procedure:

      i) Prepares plaster of Paris bandage strips as described in Task 582 (to reinforce alginate).

      ii) Prepares alginate impression material in the measures prescribed for the area to be covered and the time needed before hardening. Prepares mixing bowls, water measures, mixing spatulas and water of the correct temperature, and plans to mix only when ready to use.

      iii) Prepares tubegauze, other lubricants as described in Task 582.

      iv) Prepares materials to be used in fabrication of the solid cast as appropriate.

      v) For intraoral work may prepare an obturator for depression of tongue. If so, may remove bottom of large diameter plastic tube, tape sterile gauze over end. Plans to insert later to allow free breathing.

      vi) If patient will have a lead mask prepared after cast is made, may check that a contact or spatula-type internal eye shield has been prepared, or arranges to prepare first.

   c. Performer checks that everything to be used is ready.

   d. Checks that staff to assist or to be involved with patient are ready or available.

   e. Checks that patient is identified, available, and properly prepared.

   f. Greets patient; explains what will be done; makes note of patient's

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 3 of 5 for this task.

Code 583

Performer's Name________________ **Analyst(s)**________________ **Dept.**________
Job Title________________ **Institution**________________ **Date**________

List Elements

condition, behavior, general state as in Task 582.

g. Readies patient as in Task 582 except as follows:

- i) For intravaginal mold, may have nurse or radiotherapist prepare the vagina to receive the impression compound, insert a vaginal dilator, measure and record key dimensions, such as size of vaginal fornices, size of cervix, dimensions of vagina, length and thickness of lesions.
- ii) Measures patient between indicated body points using appropriate calipers. Records for later use in adjusting the dimensions of the negative mold impression.
- iii) For face, head, and/or neck shell, may plug patient's ears, may apply rubber cap, tubegauze, lubricant to protect hair as in Task Code 582. (Notes that alginate does not require a separating medium for removal from the skin.)
- iv) Adjusts patient in treatment position if appropriate.
- v) Inserts breathing tubes as appropriate. Has patient close eyes if appropriate.
- vi) If patient is to have lead mask cut-out made, may arrange to have patient's eye anesthetized and lead contact or spatula-type internal eye shield applied (so that the impression will fit closely and reflect the presence of the internal shield). Fixes shield in position as appropriate.

h. Mixes the alginate and water in proper proportions at proper temperature, following directions; prepares only as much at a time as can be applied without hardening.

List Elements

- i) When mixture is of a smooth consistency, performer applies rapidly and thinly over the patient's designated treatment area(s). May pour and/or use a spatula. Builds up appropriate areas. Starts at high points and allows to flow to cover all areas.
- ii) Continues with additional batches until all areas of interest are totally covered.
- iii) With vaginal or intraoral mold impression, makes sure that all the surfaces of the cavity are covered. May place a stem into alginate as an aid to later removal.

3. If the alginate impression is to be reinforced by plaster of Paris bandage, performer carries out the appropriate steps of Task Code 582, and applies the prepared plaster of Paris strips. If not, continues with step 4.

   a. Has patient hold still while mold sets.
   b. Allows mold to set for appropriate amount of time. Cleans up plaster splashes and prepares for next steps.

4. When the mold has set, performer removes it as appropriate:

   a. If an internal eye shield has been inserted, is careful not to dislodge or move it when removing mold.
   b. If mold is to be removed in pieces, cuts apart as appropriate and repeats steps for each section separately as in Task Code 582.
   c. If plaster of Paris backing was applied, may use spatula to separate outer edge of plaster and alginate from skin.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 4 of 5 for this task.

Code 583

Performer's Name________________ Analyst(s)________________ Dept.________
Job Title________________ Institution________________ Date________

List Elements

d. Removes any plaster backing as described in Task Code 582. Covers surface that was in contact with alginate with Vaseline.

e. Carefully lifts off the flexible alginate impression and places it back in its original position in or on the backing plaster (if any) using the Vaseline as an adhesive.

f. Removes intracavitary impression gently. May pull out using stem that was set into alginate material.

g. Reassembles the mold if in separate pieces and seals, as in Task Code 582. Handles carefully.

h. Coats any edges of plaster not covered by alginate with release agent.

i. Cleanses patient or has this done, removing any splashes or cast material.

   i) May remove internal eye shield gently. Places in appropriate sterilizing solution and then in distilled water. Cleans with soft swabs. Places for storage.
   ii) Has antiseptic and lubricant drops put in patient's eye or decides to do personally.
   iii) Has eye pad applied or decides to do personally.
   iv) Makes sure patient or attendant understands that eye pad is to be kept in place until sensitivity has returned to eye (such as in four hours).

j. Assists patient to leave after confirming that patient will return or be returned if appropriate, for further treatment planning and simulation.

5. Performer immediately proceeds to make a solid or sectional cast, or to mold the applicator before the alginate shrinks.

List Elements

a. Performer uses calipers and compares the measurements originally taken of the patient with the dimensions of the negative mold assembly. Adjusts as appropriate to the true interplane distances.

b. Performer checks that the materials are ready to mix the plaster of Paris, stone plaster, or resin acrylic dental material for the cast or to form the applicator mold.

c. Performer readies a head and neck negative mold for creating a positive cast, and/or prepares the intraoral or intravaginal alginate impression so that the material of which the applicator will be made can be poured over or on the alginate impression.

   i) Reinforces joints with plaster of Paris bandage or sealing strips if appropriate. Forms barriers at open end of unit so that the poured cast material will be contained. May use toweling, cloth, tissues, or other disposable material moistened with water to construct barrier(s) as appropriate. May tape into place.
   ii) May apply successive layers of plaster of Paris to reinforce the form and fix the alginate before continuing with casting. May allow this reinforced mold to dry for appropriate period.
   iii) After the impression has hardened, been removed, reassembled, and sealed, performer places in position to receive the cast mixture. Stabilizes on work table.
   iv) Coats the inside surface of mold (or outside surface of intracavitary impression) with a sep-

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
Code 583
This is page 5 of 5 for this task.

Performer's Name ______________ Analyst(s) ______________ Dept. ________
Job Title ______________ Institution ______________ Date ________

List Elements

arating (release) agent as appropriate.

d. Performer mixes the plaster of Paris, stone plaster or resin acrylic dental material as appropriate.

e. With liquid resin acrylic, pours mixture into mold or onto the surface of intracavitary impression as appropriate. Plans to allow to cool at room temperature.

f. For intracavitary impression may obtain a box mold and apply a separating medium to its interior surfaces.

   i) To form a two-section mold, may prepare and pour a "thin mix' into the box mold until it is half-full. Submerges the impression half way; allows this first section to harden.
   ii) Drills two or more holes in the top surface of the first section where it will be joined by the second section. Applies separating medium to the entire surface.
   iii) Prepares another "thin-mix" and pours into container until the container is full, filling the holes drilled in the surface of the first section and forming "prongs" for filling the parts to be joined together later. Plans to allow parts to dry thoroughly.

g. With plaster of Paris or stone plaster, pours the mixture when it is of a creamy consistency.

   i) If completely filling the mold to form a solid cast model, taps or vibrates to release trapped air bubbles.
   ii) May apply the mixture to surfaces to create a reinforced positive shell without filling in entire mold, such as in preparation for a lead cut-out mask.

List Elements

   iii) Plans to allow to dry at room temperature or to use a temperature-controlled oven or a heating lamp for the appropriate amount of time.

h. Attaches identification information to cast or mold as appropriate. Places for hardening as appropriate in appropriate location in room, in oven, or under heating lamp. Sets timer and heat controls as appropriate.

i. Arranges to have positive cast, or applicator mold, or sections removed from the impression mold after appropriate period of drying, to be worked with in the next stage of production of the shell, cast, mold, or mask.

j. Records as appropriate.

TASK CODE	EXTENDED TASK NAME
584	Preparing an intracavitary or surface applicator mold to receive radioactive sealed sources, by checking that mold or cast has hardened as appropriate; checking identification; reviewing position, distances, lengths, angles and number of nylon tubes to be placed to hold radioactive source, whether lead shielding will be included; removing impression material as appropriate; polishing acrylic applicator mold or sections with appropriate machine; preparing tubes to receive source by heating, crimping, sealing one end; preparing template in tube arrangement and marking on applicator surface; machining or otherwise placing grooves or guides for tubes on applicator; placing and attaching tubes in grooves or guides to receive radioactive source; identifying and placing for use or to receive plastic covering; recording.
585	Preparing a solid cast of plaster of Paris or stone plaster for use as model in treatment planning or for shaping lead shields by checking that cast has hardened as appropriate; checking identification; reviewing orders; removing impression material as appropriate; smoothing surfaces; applying surface markings as ordered; recording; identifying, and placing for use.
586	Forming a plastic radiotherapy treatment shell from a solid or positive cast of plaster of Paris or stone plaster using a vacuum forming machine, by checking that cast has hardened as appropriate; checking identification; preparing base for positive mold and/or smoothing surfaces of mold or solid cast; placing in vacuum machine; selecting and placing sheet of transparent plastic (lucite, plexiglass); heating plastic as appropriate to forming temperature; introducing compressed air; with cast raised into bubble, using vacuum to pull shell over positive cast; releasing vacuum; using compressed air to release shell from cast; removing shell and cast; cutting shell from sheet as appropriate, such as with soldering tool; trimming shell; cutting apart as appropriate and reassembling parts for sectional shell; drilling breathing holes if appropriate; recording; identifying, and placing for use.
587	Making an intraoral or surface stent or dental wax cast impression of a radiotherapy patient by reviewing orders; preparing supplies; reassuring, explaining to patient; heating wax composition in water bath as appropriate; measuring patient and selecting dental tray for stent compound; filling support tray with heated thermoplastic resin wax; having patient hold tray in mouth and allowing wax to cool, or pressing wax against surface treatment area with appropriate pressure until cool;

(continued)

TASK CODE	EXTENDED TASK NAME
587	(Continued) removing; identifying and placing stent or wax cast for further processing or use; arranging for patient to return; recording.
588	Fabricating a bite-block or other radiotherapy treatment mold from a wax cast by reviewing orders; preparing supplies; obtaining wax cast; checking identification; preparing plaster of Paris and pouring into box mold; immersing wax cast except for top surface; identifying; placing for dry-out; recording.
589	Preparing a lead bite-block or other lead block for radiotherapy use from a wax cast set in plaster mold, by reviewing orders; checking that plaster mold has hardened as appropriate; checking identification; inverting wax-plaster cast over heat; allowing wax to melt and run out; melting lead in ladle; pouring lead into plaster mold; allowing to cool; breaking plaster mold; identifying lead block; placing for use; recording.
590	Applying wax bolus to a radiotherapy treatment shell by reviewing treatment plan after simulation and/or initial set-up; checking that portals and treatment markings have been marked on shell; making reproduction of treatment plan on cardboard and fitting within shell at tumor plane; passing rod through shell along central axis of each beam; making wood model of portal plane; perforating in center; attaching director at right angles; placing model on rod in contact with shell surface; heating beeswax; pouring to fill air space between portal model and shell; continuing for all wax portal seatings; trimming with warm spatula; allowing to dry; removing rods, portal models, cardboard; placing to be rechecked on patient; recording.
591	Fabricating lead shielding for radiotherapy treatment fields by reviewing orders; obtaining tracing of area to be shielded (after simulation); cutting out template; determining number of layers of sheet lead foil needed to provide prescribed HVL; cutting out identical slabs of sheet lead using template and shears; laminating layers; binding with solder or adhesive; identifying; placing for use; recording.
592	Fabricating and shaping radiotherapy lead shielding or mask cutouts on a plaster cast of radiotherapy patient, by checking identification, that cast has hardened; reviewing orders, treatment plan; checking that treatment portals and outline for shielding are marked on plaster cast (after simulation or initial set-up); making tracing of area(s) to be covered by lead shielding; making template, allowing for coverage of contoured areas; cutting lead sheets(s) to shape; smoothing edges; laminating; placing lead (continued)

TASK CODE — EXTENDED TASK NAME

592 (Continued)
over cast in position; beating to conform to contours with ball-peen hammer as appropriate; burnishing for close fit; cutting any apertures as specified; cutting hole for contact eye shield if needed; trimming, smoothing edges; joining pieces by soldering or as appropriate; rechecking the fit; coating with finishing material; placing shielding or mask on cast; identifying; placing to be rechecked on patient; recording.

593 Cutting treatment portals out of radiotherapy treatment shell by checking identification, that shell is complete, that portals and treatment markings have been made in shell; cutting out areas indicated using appropriate tools; smoothing; placing to be rechecked on patient; recording.

594 Fabricating a contact or spatula-type internal eye shield for radiotherapy by reviewing orders; noting dimensions of corneal radii (at right angles); preparing materials; for contact shield, preparing lead-alloy casting to fit selected standard size radii, including small peg at center for use in removal; lining lead shield with plastic shell; peening edges and sealing; handling with forceps and taking care not to scratch soft lead; for spatula shield, selecting lead shielding of appropriate width to fit the two right angle dimensions; forming small handle at one end and drilling hole for nylon tie; cutting, shaping, trimming and burnishing lead; affixing tie; sealing with non-toxic polyethylene coating with appropriate process; sterilizing shields as appropriate; identifying; placing to be rechecked on patient; recording.

595 Fitting a radiotherapy treatment shell to a patient, fixing to supports and/or attaching straps, by checking that shell is ready; reviewing treatment plan; preparing materials; joining patient during or after simulation or set-up, or reassuring, explaining to patient and positioning personally in treatment position; placing angle board, supports, head holder, shapers, foam wedges to achieve correct angulations; checking that finished shell fits only with patient in treatment position; drawing in alignment marks; checking and fixing position of angle board, shapers, supports, support brackets; cutting and shaping supports and shapers; cooling; replacing on shell; marking parts; applying solvent to joints; attaching straps to fasten shell to head holder and/or table; identifying; having recheck made; adjusting; having patient taken to next location; placing shell for use; recording.

596 Preparing and/or arranging external beam radiotherapy beam blocks or compensating filters of prescribed shape and HVL for use in shadow tray by checking orders, marked out verification or wire

(continued)

TASK CODE	EXTENDED TASK NAME
596	(Continued) films, or plate on which arrangement of blocks has been outlined; noting shapes and HVL required; cutting blocks from lead stock or using prefabricated units; arranging blocks or filter material on platform, plate, tray or other device on which blocks will be arranged for placement in the path of the beam; replicating desired blocked area HVL and shapes; checking; securing in position, identifying; writing out assembly instructions if needed; placing for use; recording.
597	Fabricating radiotherapy styrofoam molds for beam blocking using marked radiograph, treatment geometry and a hot wire cutting device by checking prepared radiograph, orders; preparing, arranging equipment and materials; placing marked radiograph (after simulation) at prescribed source-to-film distance in device; placing styrofoam block at prescribed source-to-shadow tray distance; centering; setting wire tension and heat; tracing the outline of the areas to be shielded as marked on radiograph with pointer, thereby activating hot-wire cutter to shape and cut the styrofoam block (with tapered edge to conform with divergence of radiation beam except in area marked for vertical cut); checking shape with light system; adjusting; attaching identification information; placing mold to be filled with lead; recording.
598	Fabricating customized lead radiotherapy shielding beam blocks with styrofoam molds by checking orders, styrofoam molds, identification; preparing and heating low-melting blocking alloy or lead and paraffin wax; placing molds; attaching to holders; pouring blocking material into molds; allowing to cool; trimming; attaching identification information; placing to be checked in simulation; recording.

TASK DESCRIPTION SHEET

Task Code No. 599

This is page 1 of 22 for this task.

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Patient set up for external beam radiation therapy; treatment dosage administered; patient's condition noted and/or reported; treatment recorded; patient reassured, given explanation, instructions; materials, records placed for use; patient sent or escorted to next location.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt's radiotherapy treatment plan,requisition sheet, ID card,bracelet,medical-technical chart,prior radiographs,scans;view boxes;external beam treatment machine,controls,intercom;distance,beam angle indicators;table;light system;collimator;beam accessory holder;blocking tray;cones,applicators,periscope; scales,rulers;x-ray film,holders,cassettes;cassette holder;immobilization devices;stent;eye pads,shields; lead shielding,stent,bite block;ID markers;beam blocks;treatment shell,mask;beam direction device, pin and arc,back pointer,side lights;beam block diagram;tape;dye,ink,sticks;wedge filters;tissue compensator;bolus;cardboard cut-out;pen,pencil;pt. instructions;stretcher,wheelchair;barium mixture; procedure tray;support stand;transparent film;level; forms;soap,water;calipers

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Any radiotherapy patient;radiotherapist;co-worker; family member;nurse

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Setting up any radiotherapy patient and administering external beam radiation therapy to the head and/or neck and/or spinal column by reviewing treatment plan;preparing equipment and materials;reassuring, attending to pt's condition;noting,reporting danger signs to radiotherapist;positioning,immobilizing pt. for treatment using custom-made devices,treatment shell,applicators,stent;laying out direct,oblique, parallel opposed,wedge,and/or wedge-pair treatment fields;laying out shielding or blocking for tissues to be spared;making verification film;setting controls for prescribed dosage;administering radiation dosage;repeating for all fields;explaining self care, after-effects,danger signs to pt.;disassembling set-up;recording treatment;having pt.transported;placing records,materials for use.

List Elements Fully

Performer sets up any radiotherapy patient and administers external beam radiation therapy for a scheduled treatment of patient's head and/or neck and/or spinal column.

1. Depending on institutional procedures, performer receives or obtains the patient's treatment chart, the approved treatment plan, consent form, any verification portal films (taken during simulation and/or treatment), accessories to aid in set-up, such as patient's contour, cardboard cut-out, the patient's treatment record sheet, information on the field dimensions, location, and any related medical information such as results of laboratory and other tests.

2. Performer reviews background information on a patient in current treatment, or reads information on a new patient to become familiar with the case. Determines what type of treatment set-up is called for, the patient involved, his or her condition, the area(s) to be treated, the purpose, the equipment involved, any special considerations, and checks the completeness of the information provided; plans procedure:

   a. Performer notes the patient involved, the condition, and the area(s) to be treated (treatment volumes); plans procedure:

OK-RP;RR:RR

6. Check here if this is a master sheet..(X)

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i) Notes the patient's name, identification number, sex, height, weight, and age. Notes the name of the radiotherapist in charge.

ii) Notes whether patient is in-patient, out-patient, to be treated as emergency patient.

iii) Notes the type, stage, and location of the tumor, the treatment volume(s), number of fields to be treated.

iv) Notes whether treatment is the first for the patient, whether there is a change in the treatment plan for a current patient (such as for a booster treatment, reduced field, change as a result of an error being found in treatment geometry), whether treatment is to continue according to current plan. Notes time elapse since last treatment, whether patient has missed any treatments.

v) Notes the machine selected for treatment, such as gamma ray megavoltage source (such as cobalt-60), megavoltage electron beam or x-ray source (such as betatron or linear accelerator, superficial x-ray source (such as Grenz rays), orthovoltage x-ray source, or a combination for various fields.

vi) Notes whether an intraoral cone, periscope applicator, and/or submental pressure cone will be needed.

vii) For organ such as the eye, notes whether there is to be unilateral or bilateral radiation; if bilateral, notes side of interest. Notes whether a contralateral eye has been enucleated.

viii) Notes whether the approved treatment technique is for radical (curative) or palliative purposes, whether the therapy is to be done in conjunction with other modalities such as surgery, interstitial or intracavitary radiation, and/or chemotherapy. Notes whether radiation therapy is pre-operative, post-operative.

ix) Notes which portal(s) are scheduled to be treated during the given treatment.

x) Notes whether treatment verification films are to be made after patient is set up for treatment (as standard quality assurance procedure or as requested). If so, may plan to use diagnostic x-ray capability of the treatment machine or plans to make "beam film(s)" using the treatment beam as appropriate.

b. If the patient is new or there has been a change in the treatment plan, checks whether physicist or radiotherapist has signed treatment chart indicating that physics plan and dosimetry calculations have been reviewed. May arrange to have calculations made and/or checked as appropriate before proceeding with treatment.

c. For new patient, checks whether consent form is signed and present. If not, may arrange to have radiotherapist talk with patient and/or authorized adult. Does not proceed with treatment until consent form is signed; if necessary, arranges to have patient rescheduled.

d. Reviews the patient's current medical condition in order to provide appropriate preparation and be aware of relevant changes in patient's condition, appearance, or behavior.

i) Notes results of periodic examinations, including complete blood count and any notes made by the radiotherapist during the last status check. Notes any history of adverse or incipient

TASK DESCRIPTION SHEET (continued)

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adverse reaction to radiation, comments on current behavior or emotional state.

ii) Checks whether patient is suffering from a collateral condition requiring special attention in handling, such as heart disease, communicable or infectious condition, infirmity, incoherence, behavioral disorder.

iii) Checks whether patient such as epileptic must be treated on a ground-level stretcher to protect patient from accident.

iv) Notes whether patient will have IV drip, oxygen supply, urinary catheter, colostomy, T-tube, or similar device attached, interfering with the patient's mobility.

v) Notes whether patient will be arriving on stretcher, wheelchair, will be accompanied by nurse, other staff, parent or guardian.

vi) Depending on institutional procedures, performer may note whether female patient is pregnant, reviews date of female patient's last menstrual period, or notes any other indication that there is no danger of exposure of a known or possible fetus. If female patient is or may be pregnant, notes what fetus protection must be ensured. Notes any additional protective shielding that may be appropriate.

vii) Notes whether patient, such as pediatric patient, may require prior sedation, special immobilization equipment.

viii) Considers whether the age and condition of the patient and the type of tumor require special nursing services. Notes whether dressing will have to be removed, surfaces cleansed, and/or dressings replaced.

List Elements Fully

ix) Considers whether the patient's psychological state must be considered to ensure proper attention to the patient.

x) Considers whether the patient requires the services of an interpreter.

xi) Notes whether patient wears dentures.

e. Performer may note and check on any prior preparation and/or concurrent procedures ordered for patient as listed in chart or requisition sheet:

i) Performer may note whether orders for prior nursing preparations have been given and carried out; if not already done, may arrange to have orders carried out or informs appropriate staff member.

ii) If patient's record indicates orders for sedation or any other prior medication, performer may check timing to be sure a proper elapse of time has occurred for medication to take effect. May arrange to delay procedure if appropriate.

iii) If lab tests, dental consultation, clinical care have been ordered to be done prior to treatment, performer checks that these have been carried out and that results are with patient's chart.

iv) If treatment of the eye is involved, notes whether local anesthetic is to be administered prior to treatment or once patient is in room. Notes whether an internal shield or contact lens will be fitted into place.

v) Notes whether a staff member is required to introduce intraoral

TASK DESCRIPTION SHEET (continued)

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stent, periscope applicator or approve placement of wedge filters.

vi) Notes names of other staff members assigned (if any). If appropriate, checks that any staff needed for interpreting, nursing or other services are present.

f. Performer reviews the treatment plan to be sure he or she understands what is required and to check that all the needed information is present:

i) With regard to the field arrangements, performer notes the number of fields, the locations, the specified size of each, the orientation of each field, any non-regular shapes or beam angulation required, field separation required.

ii) Notes what methods will be used to define the edges of the field, such as patient markings and use of light system, cut-outs of cast, mask,or shell, visible superficial lesions.

iii) Notes what field arrangement has been prescribed, such as single direct or oblique field, direct or oblique parallel opposed AP or lateral fields, multiple converging fields, wedge or wedge pair fields, split beam field, intraoral or submental field, field within a field. Notes whether a single posterior field including spinal cord and brain will be used, cranial field(s) with two sets of unequal-length contiguous spinal fields, or a combination of these for condition such as medulloblastoma.

iv) Checks which field(s) are to be treated at this time, and in what order if more than one field will be treated.

List Elements Fully

v) Checks the suggested position of the patient for each treatment field, such as supine, lying on side, prone, erect in chair provided with head support.

vi) Notes whether an extension cone will be needed to reduce the beam to a field smaller than the smallest size available with the collimator. Notes the size of the extension cone needed.

vii) For wedge field arrangements, notes the wedge angle(s) selected, the orientation of the field(s), the "hinge angle" between fields and the lengths of each field.

viii) Notes the appropriate type of applicator for the given modality, such as open ended applicator attached to cut-out field in shell, mask, or cast, intraoral or submental cone seated in mold, or intraoral stent, or bite block.

ix) Checks the required distance from the source or target to the center of the field (TSD or SSD). For fields that are irregular or not flat, notes where the nominal SSD is to be measured, such as at center of field, at the shortest SSD in the treatment field, or as designated.

x) Notes what materials will be used to limit the beam to the area of interest, such as lead beam blocks suspended in shadow tray holder over patient, lead screen or blocks arranged on platform (such as for medulloblastoma), treatment shell, cast,or mask with cut-out for head or neck field, direct use of shielding, lead mask or cutouts, use of applicator or cones, depending on the equipment and the location of the tumor.

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xi) Notes what positioning and immobilization devices will be used, such as shell or cast, head support, intraoral stent, intraorbital applicator with built-in shielding, back pointer, pin and arc, side lights, triangulation marks. Notes whether patient will be positioned in treatment shell, whether head holder or angle board is incorporated in a unit with treatment shell.

xii) Notes special shielding ordered for sensitive tissue such as lead shielding, eye shields, strips of shielding to be applied to nasal septum, mouthpiece to be placed behind the mucosal surface of the lips to shield teeth and the alveolus, or lead bite block. Notes whether head holder, masking tape, sand bags, or cork will be used to immobilize and/or keep tongue or jaw out of the central beam. Notes the appropriate gonadal shielding and any protection needed for a fetus.

xiii) Notes any tissue compensating devices to be used for differential attenuation of the beam in cases of eccentric tumors or to restore the effect of a flat surface when the treatment surface is not flat, such as bolus, wax mold, tissue compensating filters to be placed in beam.

xiv) Notes whether filters are to be added to the beam column to affect beam quality.

g. Performer reviews the radiation dosage to be administered to each field to be treated during this particular visit by patient.

i) If betatron or linear accelerator has been prescribed, checks whether x-ray or electron beam

List Elements Fully

modality has been selected.

ii) May review the minimum cumulative tumor dose needed to effect the curative or palliative objective for the treatment plan involved, the maximum dose to be allowed to normal tissue (maximum allowable given dose set by the institution, modified to reflect proximity of tumor to radiosensitive tissues), the number of treatments, and frequency of treatments for each field (fractionation).

iii) Notes the daily given dose for each portal to be treated, whether this is a standard dose or result of special calculations.

iv) Notes the dosage to be administered in terms of dosimeter units or time, depending on the equipment to be used, the portal(s) to be treated, and the type of exposure control to be used.

h. If the performer determines that the treatment plan is not properly authorized, is incomplete, that sufficient information is lacking for performer to set up and administer the treatment, or if patient's absence requires review of treatment plan, notifies supervisor, radiotherapist, physicist or other designated staff person, depending on institutional procedures.

i) If performer has any questions about the treatment plan, discusses with appropriate staff person such as radiotherapist.

ii) Proceeds after obtaining needed information, signature, or orders.

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3. When performer is clear about what will be involved in the set-up and treatment, he or she prepares ahead so as not to keep the patient in the treatment room longer than necessary:

   a. If performer is not already assigned to a particular treatment room, notes the machine and room assigned and goes there.
   b. If using a treatment machine with a diagnostic-type x-ray tube for treatment verification films, makes sure that the alignment of the diagnostic beam with the treatment beam has been checked, or has this done.
   c. If using a light system for setting up the treatment field, makes sure that the alignment of the light beam with the radiation beam has been checked, or has this done.
   d. Checks that the output of the treatment machine has been calibrated within the prescribed period of time and that equipment is ready for use.
   e. Washes hands as appropriate.
   f. Checks that any materials ordered for positioning or immobilizing patient and/or to define the portals or provide for beam blocking, filtering, directing or seating are present, and/or that these were checked and approved during prior simulation or initial set-up.

      i) Checks that portals have been cut out of lead mask or treatment shell and approved if so ordered.
      ii) Checks whether treatment shell has been secured to an angle board or head holder if so ordered. For shell of more than one piece, checks that all pieces are present.
      iii) Makes sure that appropriate field dimensions, triangulation marks, beam directing and centering marks are visible on treatment shell, mask or cast.

List Elements Fully

      iv) If appropriate, checks that bolus(es) have been prepared and attached to treatment shell.
      v) Checks that any shell, intraoral stent, or bite block ordered to protect the tongue and other tissues and/or provide a seating for an intraoral cone or applicator has been checked and is ready.
      vi) Checks that customized or standard beam blocks for megavoltage equipment are present. May check for plates marked with diagram of beam block arrangement.
      vii) For orthovoltage or superficial treatment, checks for lead shielding cut-outs. May check for gonadal shields.
      viii) Checks that appropriate size cones, extenders, filters are present depending on the equipment involved and the field sizes to be set up.
      ix) Checks that procedure tray is equipped as appropriate, based on requisition. For treatment of eye, may check for sterile solutions, anesthetic, eye pad. May check that any internal eye shield to be used is smooth, that its surfaces will not cause corneal abrasion, and that it is sterilized. Checks that materials are present to reinforce patient markings.
      x) If treatment verification film(s) will be made, makes sure that an adequate supply of loaded cassettes of the appropriate types and sizes are available, radiopaque right and left markers, and identification markers.
      xi) Checks that treatment table is prepared with clean linens or cover as appropriate. Checks

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that immobilization devices and supports are available to make patient comfortable.

g. Checks that appropriate attachments are in place on the unit head:

i) May check that accessories are in place, such as collimator holder, tray for beam blocks to be used with megavoltage equipment. If appropriate, obtains tray to hold lead blocks and attaches to accessory ring on unit head at prescribed height.

ii) May plan to position special beam block stand above treatment table for use in defining cerebrospinal or spinal field(s) (for medulloblastoma).

iii) For superficial or conventional x-ray beam therapy, if a filter has been prescribed to produce a homogeneous beam quality, may insert in unit head above cone holder or dial correct filter. When using filter of more than one metal, e.g., copper and aluminum, may make sure that filter is inserted with aluminum side nearest the table and facing away from the target.

iv) If a cone applicator or extension cone has been prescribed, performer inserts into cone holder on unit head as appropriate. May attach cone extender.

v) For intracavitary treatment involving a periscope applicator, checks that this has been prepared. Inserts into cone holder or unit head.

vi) If appropriate for the equipment, performer may adjust a centimeter scale for the prescribed SSD and insert it into the beam column.

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vii) With betatron, depending on whether electron beam or x-ray modality is to be used, checks that appropriate attachments are in place on the unit head, such as collimator holder and beta ionization chamber for electron beam use. May attach appropriate size collimator (for use with electron beam mode) to collimator holder in unit head.

h. Prepares treatment table, couch or chair as appropriate:

i) If treatment table or chair is not permanently fixed to the unit head in an isocentric position, checks that correct treatment table is in place (such as one with open bottom when treatment head is to rotate underneath patient for posterior field).

ii) Positions table and couples or uncouples as appropriate. May move table away if patient is to be treated at floor level on stretcher.

iii) If immobilization shell will be used, may obtain shell attached to angle board or head holder and secure in position on treatment table or chair. May place lower half of multi-part shell into position on table or chair.

i. If treatment verification films will be made, prepares identification marker; obtains loaded cassette or film holder of type appropriate for the equipment, and size appropriate for the first field to be treated. Attaches identification information as appropriate and places in position for first field in cassette tray or

TASK DESCRIPTION SHEET (continued)

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tunnel, in slot in head rest, or in vertical holder.

j. Performer may check that treatment equipment is ready for use.

   i) Checks that safety warning lights are operative above treatment room and control room doors, and that no unauthorized persons are in either room.
   ii) Enters control room and checks that unit is in safe "off" position and that timer control is at zero or at "off" position.
   iii) For x-ray equipment checks that main power is on and machine is "warmed up" and in readiness position as appropriate. May turn on magnetic lock switch; may adjust line voltage. Checks that machine is set for the appropriate modality, such as diagnostic x-ray modality if procedure will start with verification filming.
   iv) For gamma ray teletherapy equipment, makes sure that the source is in a retracted "safe," closed-shutter position and that the timer switch is on "off" position.
   v) For betatron or linear accelerator, checks that changeover switch is set for appropriate x-ray treatment beam, or electron beam, or diagnostic x-ray beam modality as appropriate. Checks that necessary warm-up steps have been taken and that machine is ready for use.
   vi) Checks intercom and TV monitor.

k. Performer may set technical factors for verification filming or treatment of the first portal as appropriate. Checks treatment chart.

   i) May set appropriate treatment room pre-selection controls.

List Elements Fully

   ii) Sets for appropriate modality if not already done.
   iii) For x-ray beam modality sets for the prescribed kilovoltage, amperage and time. May set appropriate pre-voltage factor determined from the prescribed kVp.
   iv) For gamma ray modality sets for appropriate time.
   v) For betatron, depending on whether an electron beam (beta ray) or an x-ray beam is to be used, performer selects and sets controls to equalize the field size for the prescribed energy level. Turns on the magnetic field. Checks that proper light goes on and that there is a reading on the amperemeter and the MeV-meter. Sets for prescribed megavoltage. Sets for expansion (and also extraction when beta setting has been chosen).
   vi) Sets the radiation controls by choosing the dosimeter setting or the dose rate meter setting as given by the treatment plan.
   vii) If a dosimeter is to be used, selects the prescribed dosage by turning the dials until the selected dose in "kicks" or monitor units appears in the indicator windows. Sets the dosimeter at the setting dialed. Connects the counter and checks that its indicators match the dose setting indicators. May also use a timer and set to the estimated time needed to deliver the prescribed dose so that, if machine fails to turn off after dosimeter has registered zero, performer can use time left on timer to estimate dose given to patient.

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viii) If a dose rate meter is to be used, sets the dose rate meter to the time prescribed, and sets the dose rate meter sensitivity control in the appropriate time units.

ix) If performer finds any of the controls inoperative, notifies appropriate staff member. Proceeds as ordered.

x) Performer may depress a re-set button on the control panel. Makes sure that machine is still in "beam off" and/or "shutter closed" position.

4. Performer readies the patient for the set-up and treatment:

a. Performer washes hands as appropriate. Depending on patient's condition and the materials involved, follows appropriate antiseptic and aseptic techniques.

b. Performer has the patient brought from the holding area and prepared for the treatment (if not already done), or decides to do personally. Depending on institutional arrangements, performer may decide to assist in bringing patient to the treatment room.

c. Performer greets patient and any accompanying staff person and/or parent or guardian, and introduces self. Checks patient's identity against the requisition sheet. With in-patient, checks hospital identification bracelet or other identifier. Checks with any accompanying staff member on any special precautions necessary during treatment.

d. Performer makes patient comfortable on the table, couch, chair, on stretcher on ground, or as appropriate to the type of treatment planned.

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i) If appropriate, has patient on stretcher moved into treatment table location (at ground level if required for safety of patient, such as epileptic).

ii) If patient is in wheelchair, may move patient in chair into position next to table. Makes sure that wheelchair is in locked position.

iii) Performer may decide to assist patient to table or has this done. May obtain help. Makes sure that no equipment is in the way that may be collided with by patient. If assisting patient to step on footstool in order to get on table, helps patient turn into position, step backwards on stool, and then sit and/or lie on table. May raise or lower table.

iv) May have nurse carefully place young patient on table, or lifts patient carefully and places on table.

v) If patient has a life support system in place, such as respirator, cardiac or infusion equipment, or if patient is under anesthesia, makes sure that this is being monitored.

vi) If there is a wet dressing, performer has it reinforced or decides to do personally.

vii) Makes sure patient is being attended and there is no danger patient will fall.

e. If this is the first treatment or a change in treatment plan, performer carefully explains to patient and/or family member the set-up procedures and what to expect. Uses language appropriate to patient's level of comprehension.

TASK DESCRIPTION SHEET (continued)

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- i) Explains to patient and/or family member what steps will be carried out, what positions patient will be in, what immobilization devices will be used, what cooperation will be asked of patient.
- ii) Notes that radiation therapy patients may be concerned or frightened about the procedures involved. May explain what radiotherapy is.
- iii) Explains that the external radiation will not make the patient become radioactive, that patient will not be a hazard to anyone.
- iv) Explains that the radiation produces no sensation.
- v) Explains the need for immobilization devices.
- vi) Explains why patient will be in separate room for treatment, how patient remains under observation, and shows how patient can communicate with performer during filming and/or treatment. May practice using inter-communication system.
- vii) Explains equipment in layman's terms if patient is concerned about the massive appearance of the equipment.
- viii) Explains how patient can help by remaining perfectly still during the treatment.
- ix) If an adult family member is to be allowed to be present with patient during any part of the set-up procedure, makes sure that such a person understands that he or she cannot be present during actual therapy.
- x) If appropriate and not already done, performer questions female patient of child bearing age regarding possible pregnancy. If there is any possibility that patient is pregnant, and this has not already been recorded, performer informs radiotherapist in charge at once; proceeds only with approval.

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f. If not already done, performer has patient undressed as appropriate for treatment and draped with sheet, if appropriate.

- i) If not already done, has patient remove dentures, hair pins, spectacles, and any jewelry from head and neck.
- ii) May tie patient's hair or wrap so that hair is kept away from treatment area. May have patient use hair net.
- iii) May swaddle child or have this done.

g. Performer attempts to establish a supportive relationship with the patient while preparing for the treatment. If necessary may converse through interpreter.

- i) Performer exercises care in reassuring patient while treating patient with dignity and compassion, bearing in mind that patient is suffering from a malignant disease that may be terminal, or with uncertain or poor prognosis. Without being blandly optimistic, performer tries to put patient at ease.
- ii) Considers the patient's psychological state, noting that the diagnosis may have been recent. Notes that patient may be frightened, emotionally disturbed, subject to behavioral disorders, may be incoherent, depressed, withdrawn, bitter or hostile. Performer attempts to exercise consideration, respect, understanding, and as much warmth as possible. Treats patient with dignity and concern regardless

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of patient's behavior or age.

iii) Performer is careful to be supportive of patient with respect to the patient's self-concept, body image and acceptance of the situation that there is a disease condition to be treated or palliated.

iv) If this is the patient's first treatment, performer attempts to develop and maintain a trusting relationship of mutual respect. Makes note of the patient's general appearance, behavior, and emotional affect in order to be aware of any marked changes over the course of the treatment.

h. If treatment is one of a series already started, performer may question patient about any symptoms, discomforts, eating habits, changes in bowel functioning. Makes note of patient's general appearance, behavior, and/or physical condition. Observes and/or asks about relevant indications or symptoms.

i) Notes or asks about skin reactions, nausea, fever, loss of appetite, headache, fatigue, changes in eating habits, fluid intake and output, bowel movements, any pain.

ii) Checks for abnormal skin color, mucositis (inflammation of mucous membranes), loss of function of salivary glands, loss of sensation of taste, sore throat, loss of vision, double vision, indications of cataracts, conjunctivitis, loss of eyelashes, disorientation (vertigo), abnormal speech patterns.

iii) Checks for behavioral idiosyncracies, irrational or marked deviations from patient's normal state.

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iv) Performer decides whether patient displays medical or behavioral symptoms which should be brought to radiotherapist's attention before proceeding.

v) May arrange to obtain medication, skin lotion. anti-nausea pills, diet counseling for patient.

vi) If performer decides to notify radiotherapist, performer is careful to do this so as not to alarm the patient. Performer may call radiotherapist on phone and remain with patient, or may have co-worker remain with patient and may bring patient's treatment chart to radiotherapist. Performer arranges to cancel treatment or continue, based on orders from radiotherapist.

vii) If sedative, analgesic or other medication is prescribed, performer proceeds as appropriate, allowing time for medication to take effect.

i. Performer answers patient's or family member's non-medical questions honestly; attempts to reassure patient and develop confidence.

i) If performer notes that a patient or patient's family is misinformed about the treatment objectives, such as whether treatment is for palliation or cure, performer brings this to the attention of the radiotherapist in charge so that the physician can clarify the purpose of the treatment to the patient or family persons involved.

ii) If questioned about medical prognosis, performer refers patient to his or her attending radiotherapist and indicates that refusal is result of ethical con-

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siderations rather than unwillingness to deal with patient. Performer does not lie or invent information.

iii) Performer discusses the patient's case only with the radiotherapist in charge.

j. Performer checks patient's treatment markings such as field outlines, areas to be shielded or blocked, entry and exit points, center of beam, beam direction marks, triangulation marks showing center of field and side light positions.

  i) Notes outlines for full fields and reduced field-within-a-field, and determines correct field for the given treatment.
  ii) If performer notes that patient markings are fading, reapplies with prepared vegetable dye, using a stick.
  iii) If the markings have been obliterated, arranges to have simulation and/or set-up procedures repeated.

k. At appropriate point in procedure performer may have special immobilization or shielding procedures carried out by appropriate staff member, or carries out personally if qualified:

  i) May have physician anesthetize patient's eye(s), or may apply anesthetic eye drops personally. May have internal eye shield inserted over anesthetized eyeball. May have upper lid retracted. May have contact lens with lead markers inserted into eye.
  ii) For a nasal portal, such as for lesions at or above the equator on the nasal aspect of the retina, may request that radiotherapist adjust tip of beam

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directing applicator by fitting into socket of enucleated eye, and angle it to avoid the lens of the contralateral eye.
  iii) May have shielding inserted into nostrils to protect the nasal septum or does personally.
  iv) May have radiotherapist insert intraoral stent, tongue block, or other protection device as appropriate. May have tongue and lower jaw positioned with mouth bite block, or cork and tongue blade.
  v) If a treatment verification film will be made, and if appropriate, may have a barium swallow prepared. Administers to patient at appropriate time, or has this done.

5. Performer sets up the patient for the first field to be treated. Refers to patient's treatment chart and patient markings.

  a. Places, assists, or has patient assume the appropriate position for the first treatment field, such as lying supine on table for anterior or lateral portals, prone (with head fixed over end of treatment couch for a single cerebrospinal field) for posterior fields, seated for submental or intraoral portals, or lying on side with head supported in lateral position (for some head and/or neck portals).

    i) Is careful to dislodge any support apparatus such as IV.
    ii) May align and center patient using midline markers on table.
    iii) If appropriate, turns on sidelights (lights at exactly the same level on either side of room creating a single horizontal light beam at a given height).

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b. If a treatment cast or shell has been fabricated for the patient and attached to angle board or head holder, performer may assist patient into position in shell that has been attached to table or chair. Fits a mask directly on patient.

   i) Lines up cast, mask or shell as appropriate with anatomical marks, and checks positioning on the basis that the device only fits properly with patient in correct treatment position.
   ii) Adjusts cast, mask or shell as appropriate so that the device is in prescribed position on table. Checks that patient is comfortable but unable to move the area to be treated.
   iii) For two-part shell, may position lower part, adjust patient, and then place and secure upper portion.
   iv) If the treatment portal has been cut out of the mask or shell, checks that the cut-out coincides with the markings on the patient.

c. For direct fields, checks that head of machine and gantry swivel are at zero or ninety degree position depending on patient's position. Adjusts if necessary. Checks that treatment table, couch, or stretcher is in correct position.

d. For intraoral treatment field, sets up periscope applicator as appropriate or asks radiotherapist to apply. May move applicator attached to cone holder in unit head into position and attach distal end to the seating in the intraoral stent already inserted; may ask to have this done by radiotherapist.

e. For submental field or for other field which requires a pressure cone or extension cone applied directly to patient's skin (to create the appropriate portal at the SSD prescribed), moves unit head holding cone and any extender using appropriate controls so that end of the cone (open or closed as appropriate) is in direct contact with the marked-out treatment field on patient or is directly engaged in seating provided in the patient's cast, mask or shell.

f. Performer applies any appropriate immobilization devices to patient to keep patient in a constant position which is comfortable enough to maintain and appropriate for the tumor type, location, and the equipment to be used.

   i) May use weighted bags, foam rubber pads, head clamp, straps, tape or other devices as prescribed or as deemed necessary. May tie down palsied limbs.
   ii) May ask patient about how comfortable the position is and adjust if possible.
   iii) May reassure child who is frightened by the immobilization procedures. May place a bright object to be used to attract a young child's attention to fix the patient's gaze.
   iv) May direct patient to turn eye to one side or another to avoid the path of the beam.
   v) After patient has been immobilized, performer makes sure that patient is still able to make small movements necessary for normal circulation, respiration and other vital functions.

g. Unless the SSD for the treatment field has been obtained by use of applicator, cone, or intraoral periscope device in contact with the field, performer adjusts the treatment machine to the source-to-skin

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distance (SSD) prescribed for the first direct treatment field being set up.

i) May use optical distance meter and collimator light system to read SSD. May use centimeter scale set in beam column placed in direct contact with patient's skin.

ii) Activates the light system. May dim room lights.

iii) Adjusts the collimator opening to include an area somewhat larger than the marked-out field size. Uses the cross-hair shadow as reference for center of field, and centers to the center mark on the patient's skin, shell, or cast.

iv) Adjusts the height of the treatment table, patient and/or beam column until the side lights coincide with the lateral patient markings, while the portal remains centered to the central ray, with beam column at zero or 90 degrees.

v) For field surfaces that are not flat, performer measures SSD as prescribed, such as from center of field, at shortest possible SSD, or at a level half the distance of the spread from the shortest and longest possible SSD in the treatment field.

vi) For medulloblastoma posterior field, raises the beam column and/or lowers table so that the recorded SSD is obtained (that includes the entire length of the posterior field). May adjust beam angulation to a cephalad angle as ordered to avoid irradiation of the eyes.

vii) Using distance indicator, or the distance at which the centimeter scale touches the skin (or cast, shell, or mask), performer adjusts height of beam column and/

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or table height to the prescribed SSD. Locks into position. Checks distance. Removes centimeter scale.

h. Performer may set up as follows for an obliquely incident beam field:

i) Unlocks unit head's rotation controls. Rotates head to prescribed angle of incidence. Checks angulation by reading appropriate scale. May use collimator light to adjust beam angulation and SSD until the light cast covers the marked-out field at the prescribed collimator setting.

ii) If both the entry and exit points have been marked, performer may attach back pointer to accessory ring of beam column and adjust unit head until the tip of the back pointer coincides with the marked position of exit of the central ray. Checks that angle obtained is correct.

iii) If beam directing is needed, if the beam column does not have an angle scale, and if only the entry point is marked, may attach pin and arc device to accessory ring of beam column. Adjusts so that the desired SSD is achieved with the beam column centered on the tumor, following the recorded settings for the pin, arc and rod and the angle of entry of the central beam.

iv) With wedge field, performer may use cardboard cut-out to align beam. May use a pocket level fastened to the cut-out to line up cut-out with a predetermined horizontal line. Sets cardboard at right angles to the patient's

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field. Lines up marks for field edges, anatomical landmarks, beam angulation, center marks.

v) When treatment head is at prescribed angle, locks into position as appropriate.

i. Performer collimates to the exact field size specified and/or marked on patient so that the light cast from the collimator exactly coincides with the field marked out on the patient or marked or cut out on shell or mask.

i) Adjusts each collimator dimension until the border of the light cast coincides with the field outline. May use auxiliary trimmers.

ii) If the field size is too small for the collimator, performer uses the extension cone that was attached to holder. Checks size by noting whether light field cast coincides with field marked on patient, cast, shell, or mask.

iii) For split beam technique, performer sets the collimator to twice the length of the prescribed field size so that the cross-hairs of the light beam are on the marked border of the field (when blocked). Then attaches beam block to appropriate half of light area.

iv) For cerebrospinal or spinal field for medulloblastoma, performer attaches shielding blocks or lead shield supported above patient on treatment table (with window cut out to expose the treatment field). Positions patient so that the cerebral part of a single field is encompassed in the width of the opening in the beam blocks or cut-out opening in the shield. Collimates to the single posterior cerebrospinal or spinal field or

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to the first posterior spinal field to be treated.

v) When the light field corresponds to the patient's markings, performer checks that the field dimension shown on collimator controls matches the prescribed field dimensions. Locks collimator into position.

vi) If the treatment field is irregularly shaped or if the field will be defined with beam blocks as well as collimator, performer may position beam blocks on tray or on platform above patient so that the light cast exactly fits the field marked on patient or shell. For megavoltage equipment performer checks that accessory tray (with beam block diagram or plastic plate) is at prescribed height. Places standard or custom-made beam blocks of the prescribed HVL on tray in arrangement to coincide with the beam block diagram. May insert beam blocks between the two layers of the tray, insert into holder, clamp into position. Checks that the shadows cast by the blocks correspond with the areas to be shielded as marked on patient.

vii) For electron beam therapy performer may attach (tape) appropriate beam blocks to collimator. Checks as described above using light system.

viii) For equipment using lead shielding, performer obtains standard or custom-made lead cut-outs of the prescribed HVL. May place plastic wrap on patient's skin to avoid irritation. Places lead shields on patient's skin or shell in arrangement marked. May tape into place. Checks that shielded areas correspond to patient's skin markings, measured

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field separations, or anatomical references as indicated on treatment chart.

ix) For split beam technique, performer blocks upper or lower half of beam as appropriate. Checks that blocked out portion corresponds to patient markings.

x). Performer positions beam blocks or places shielding to protect any additional areas within the field such as the homolateral eye, spinal cord, trachea, larynx esophagus, lacrimal gland. Places gonadal shielding if appropriate.

j. If a tissue compensator has been prepared for an irregularly contoured field or to raise the 100 percent dose level to the skin surface, depending on the equipment, performer may proceed as follows:

i) If a bolus of tissue equivalent material has been prepared, and if not already attached to treatment shell, performer follows positioning directions and places bolus on patient's skin in areas indicated by patient markings or drawing. Secures into place.

ii) Performer may prepare a water bolus by obtaining finger cot and filling with water. Performer places water bolus in patient's mouth and has patient close mouth, or performer places bolus in orbit, or as otherwise indicated.

iii) If a tissue compensator has been prepared for placement in beam column, performer places on accessory tray as indicated. May assemble numbered parts following instructions and place on tray in the path of the central beam.

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k. If a wedge filter or wedge pair treatment fields have been prescribed, performer notes the wedge size prescribed for the first field, its angle, the orientation of the thicker end of the wedge, and the angle of incidence to the field.

i) Selects wedge filter according to size prescribed from wedge selector and inserts in accessory ring, or sets wedge selector on control panel to prescribed wedge number.

ii) For wedge pair makes sure that heel of wedge is properly placed in relation to second field (at appropriate "hinge angle").

iii) May check that a pinpoint of light at the thin end of wedge filter is visible on the field and that no strip of light is visible from the beam column on the patient's body.

l. Performer makes the treatment verification film of the first portal if appropriate. May proceed as follows:

i) If using the treatment machine to make double exposure beam films, may open collimator and make the first exposure to include an area surrounding the marked-out field. Makes the second exposure on the same film, collimated to the field outline with beam blocks in place, so that the second exposure indicates the treatment field (superimposed on first exposure).

ii) If using diagnostic x-ray capability of treatment machine, maintains patient in treatment set-up.

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iii) If not already done, places an identified cassette (or film in holder) in cassette holder or tunnel.

iv) Checks or sets the technical factors as appropriate. Makes sure machine is set to the appropriate mode.

v) If not already done, performer centers film (in holder or cassette) to the central beam. For right angle beam entry, centers film to the center of the area of interest and central beam. For obliquely incident beam, centers film to include the entry and exit portals.

vi) If appropriate, makes sure that right or left marker and other identification information will be exposed or recorded on film.

vii) When everything is ready for the exposure, explains to patient what will happen and the importance of holding still during exposure. May have patient practice holding still when requested until told to relax. If appropriate, instructs patient not to swallow during exposure.

viii) Makes sure everyone leaves the room. Explains to patient that performer and other staff are nearby in control room and that patient is under observation.

ix) Performer returns to control room to make exposure. Tells patient when to hold still by calling or using intercom. Initiates exposure by using the appropriate exposure control.

x) Makes sure exposure is terminated as appropriate.

xi) With beam films collimates and positions beam blocks for treatment and makes second exposure as described.

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xii) After exposure is completed, tells patient that he or she can relax.

xiii) Removes exposed film in cassette or holder. Has film processed at once, placed for processing, or decides to process later.

m. Throughout the procedure, performer observes the patient for any signs of emergency and/or to prevent or respond to an accident. Is alert to signs of nausea, dizziness, or sweat, suggesting faintness. Notifies nurse or radiotherapist at once. If patient shows any emergency signs or has an accident, performer calls appropriate physician or nurse at once. May decide to provide emergency first aid as well. Remains with patient or has staff member remain. Tries to make patient as comfortable as possible.

6. Performer administers radiation to the first portal to be treated:

a. When the set-up is completed, performer explains to patient how important it is to remain motionless during treatment.

i) Explains that patient will be left alone and reviews with patient what signal to use to have performer respond or how to speak on intercom.

ii) May review what movement in the machine will occur, what sounds to expect as appropriate.

b. Has everyone in treatment room except patient leave; goes to control booth.

c. If appropriate, such as for electron beam therapy with linear accelera-

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tor, may have radiotherapist check patient position and controls.

d. Performer makes sure that all controls have been set for first treatment field for correct dosage, or resets as appropriate, as described. Checks that power is on and that timer is at zero or off position.

e. Performer observes patient and machine set-up in treatment room through the window of the control booth or on TV monitor. Checks patient's position. Makes sure that only patient is in treatment room. If appropriate, checks indicator lights on pre-selection panel.

f. Performer calls to patient or uses intercom to have patient remain motionless. Initiates the radiation exposure:

i) For x-ray machine modality, turns timer switch to "on" position. Checks that desired milliamperage shows on the appropriate gauge. Checks that warning lights are on and that timer is operating.

ii) For betatron or linear accelerator, uses reset button and activates timer or dosimeter. Checks that warning lights are on.

iii) For teletherapy machine turns on timer switch and checks for warning lights. Checks that "beam off" indicator is extinguished when shutter reaches full "on" position. Checks that timer is operating.

iv) If the radiation fails to begin, performer may recheck control panel settings to be sure that all accessories are properly selected and exposure factors properly set. Corrects as appropriate or turns off machine and notifies appropriate staff member. Has patient relax.

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g. During the radiation exposure performer constantly monitors the patient and the equipment.

i) Observes patient to note any movement of patient out of the treatment position, any signs of distress or emergency. Notes any call from patient for help.

ii) Checks that the treatment head is stationary as prescribed.

iii) Observes the control panel and indicators. Checks that dosimeter, counter, or timer is functioning properly. Observes indicators and checks energy level.

iv) For electron beam therapy with betatron, checks reading on the emission indicator (current of electrons injected into accelerating tube). May adjust the contraction control setting to deliver optimum radiation. Does not reset energy control while the injection is in progress.

h. If the performer judges that the equipment is not functioning properly, if patient is in distress, or if patient moves out of the treatment position, performer turns off the radiation exposure at once:

i) May open treatment door to activate safety stop; may turn off timer switch; may push stop button; may use emergency stop bar; may use circuit breaker.

ii) Checks that radiation has ceased and/or that gamma ray source has been returned to a safe position.

i. Depending on the patient's condition, performer may provide emergency care as described, obtain help, or reposition patient as appropriate.

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i) May reexplain need for patient to remain still.
ii) May add immobilization devices.
iii) May reassure patient, or provide assistance as appropriate.
iv) May notify radiotherapist of any problem.
v) If there is a problem with the equipment, performer reassures patient. Has patient relax; informs appropriate staff member of problem with equipment.
vi) Depending on the situation and any orders, performer may resume treatment after assistance is given or adjustments made, or prepares to terminate.

j. Once any adjustments are made, performer resumes the administration of the treatment. In resetting controls after an interruption in treatment, performer turns power on again as appropriate; depresses the reset button to continue treatment; moves timer switch to "on" position as appropriate. Does not reset timer or dosimeter so that the total actual dose given can be recorded.

k. When the exposure has been terminated, performer checks for audiosignal if appropriate, and that timer switch or dosimeter has reached a zero position or otherwise indicates that the full dose has been administered and that radiation has ceased.

i) Checks that warning lights are extinguished, and/or that a "beam off" condition is being signaled.
ii) May move controls to "off" position or first position.
iii) May record final readings on indicators for energy, primary current, dose rate and emission.

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iv) If there is any indication that the source has not been fully withdrawn or that x-ray or electron beam radiation has not been terminated, performer tries all alternate or emergency means to terminate.
v) In emergency, may remove patient from treatment room, close door and notify physicist. With gamma ray source, may attempt to manually move source to a relatively safe position by turning emergency handwheel or inserting emergency "T-bar" and pushing in appropriate direction until indicator shows that source has been retracted or that shutters have been closed.

7. When the prescribed dosage has been administered to the first treatment field, performer checks patient's condition and reviews whether any additional fields are to be treated.

a. If no other field is to be treated, performer proceeds to terminate as described below.
b. If a second treatment field is to be set up, performer may proceed as follows:

i) If the proposed treatment plan calls for a pair of anterior-posterior parallel opposed fields (either direct or with beam at an oblique angle of incidence) and if beam column will not be rotated for an under-the-couch treatment, removes the immobilization devices from the patient; has the patient turn over. Assists patient if appropriate, or has co-worker assist. Realigns the patient so as to reproduce the reverse of the same field, following the mark-

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ings laid out on the reverse side.

- ii) For under-the-couch treatment rotates beam column and sets up table height as appropriate.
- iii) If the parallel opposed fields are arranged at an oblique angle of incidence, performer uses beam directing devices and/or side lights as described above; refers to markings on the patient.
- iv) For a second wedge-pair field, performer adjusts the beam column to the required angle of incidence to achieve the prescribed "hinge angle" between the fields, as ordered. Checks second wedge filter as described above. Makes sure to insert second filter so that the heel of the two wedge filters will lie towards each other.
- v) Adjusts beam column to the prescribed SSD as described, making measurement from the designated area of the field. Collimates to the field area indicated.
- vi) Reassembles lead blocks or applies lead shielding as appropriate to each field as described.
- vii) Repeats verification portal filming as appropriate.
- viii) Repeats all the appropriate set-up steps already described for the first field.

c. Sets controls and administers dosage to second field as appropriate, as described.

d. Performer continues as described for any third or more fields to be set up and treated.

e. If performer considers that patient is in distress, or if performer has any questions or has encountered any problems with the set-up or dosage, discusses with radiotherapist if not already done and continues as ordered.

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8. When all fields have been treated, performer returns to the treatment room and checks patient's condition. Moves the beam column out of the way.

a. Carefully removes any immobilization devices, shell, cast, mask, lead shielding, bolus, stents, intraoral applicators, periscope as appropriate and replaces in appropriate location.

- i) If an internal eye shield has been inserted, may gently remove or has this done.
- ii) May apply an eye pad to an eye that has been anesthetized. Indicates how long it should be worn to protect patient until eye reflexes return (such as two hours).
- iii) Has internal eye shield and/or intraoral devices placed for sterilization if appropriate, or decides to do personally.
- iv) Makes sure that any devices to be used again by the patient are identified.

b. Performer may discuss with patient what has been done in order to make clear what procedures the patient must follow or continue to follow in order to be properly treated. If appropriate, talks through interpreter, and/or talks with adult accompanying pediatric patient:

- i) Performer explains the importance of retaining the body markings which outline the field area(s). Depending on the material used, indicates or reinforces information on whether washing is prohibited.

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ii) Performer explains any prohibitions on use of cosmetics or toiletries on field area, if appropriate.

iii) Performer explains or reinforces procedures to be carried out by patient before treatment as appropriate.

c. If institutional policy, performer may answer questions about or inform patient about the side effects that can be expected with the treatment, such as skin reactions, nausea, fever, loss of appetite.

i) Encourages patient to report skin reactions, sore throat, changes in eating habits, fluid intake and output, bowel movements, any nausea or pain to the radiotherapist or nurse so that these can be noted and help provided.

ii) If not already done, may arrange to have a check list prepared and given to patient or family member to reinforce the instructions.

d. Performer notes next location for which patient is scheduled, such as recovery area, scheduling for next treatment, back to room, or whether patient is to return home.

i) Performer may have young patient fed.

ii) May decide to assist patient to leave; may decide to transport personally; or may have this done.

iii) Makes sure that none of the equipment is projecting over the patient before allowing patient to rise.

iv) May have patient transported to recovery area to rest until immediate effects of procedure and any medication have abated.

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v) If appropriate, makes sure that patient is in the care of a staff person who will transport to appropriate next location or, if out-patient, will arrange to discharge or send patient home (with parent, guardian, or escort if appropriate).

e. Performer checks that all custom-made devices are accounted for.

f. Makes sure that any treatment verification portal films are identified with patient identification information and with indications of the views involved. May include patient's name and number, physician's name, date, type of film, machine number.

g. May have room and equipment cleaned; has any other appropriate clean up procedures followed to avoid infection or contamination, or decides to do personally, depending on institutional procedures.

h. Performer records the treatment delivered according to institutional procedures.

i) Records date, time if appropriate, the number of the treatment, and the number of days since the last treatment as appropriate.

ii) Records the field reference for each field, such as its name and number. Records the treatment machine type (and identification number if appropriate).

iii) Records the prescribed dose, the given dose and the cumulative dose.

iv) May calculate and record the skin dose and/or the maximum dose on the central axis (applied dose). May calculate and record the cumulative applied dose. Uses appropriate formulae

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and information supplied in treatment plan. v) Records any appropriate related information such as whether verification films were taken, whether treatment was interrupted, any problems encountered, what was done or decided. Records any unusual behavior or symptoms of patient. vi) If the treatment is the first or at an appropriate stage in the plan, performer may mark the treatment chart or folder to initiate a check or a review of dosimetry calculation. vii) Signs chart as appropriate. i. Places all documents for logging, further processing, or filing, as appropriate. j. May indicate to appropriate staff person when the performer is ready to proceed with next set-up and treatment.	

TASK DESCRIPTION SHEET

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1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Patient set up for external beam radiation therapy; treatment dosage administered; pt.'s condition noted and/or reported; treatment recorded; pt. reassured, given explanation, instructions; materials, records placed for use; patient sent or escorted to next location.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt's radiotherapy treatment plan, requisition sheet, ID card, bracelet, medical-technical chart, prior radiographs, scans; view boxes; external beam treatment machine, controls, intercom; distance, beam angle indicators; table; light system; collimator; beam accessory holder; blocking tray; extension cones; scales, rulers; x-ray film, holders, cassettes; cassette holder; immobilization devices; ID markers; beam blocks; shell; beam direction device, pin and arc, back pointer, side lights; beam block diagram plate; tape, scissors; dye, ink, sticks; wedge filters; pen, pencil; pt. instructions; stretcher, wheelchair; barium mixture; procedure tray; forms; soap; water; strip field collimators; esophagus board

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Any radiotherapy patient; radiotherapist; co-worker; family member; nurse

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Setting up any radiotherapy patient and administering external beam radiation therapy to the thorax, for treatment of lungs, pleura, esophagus, or mediastinum, by reviewing treatment plan; preparing equipment and materials; reassuring, attending to pt.'s condition; noting, reporting danger signs to radiotherapist; positioning, immobilizing pt. for treatment; setting up direct, oblique, parallel opposed, wedge, isocentric, arc, or rotation, or moving strip treatment fields; positioning beam blocks; making verification films; setting controls for prescribed dosage; administering radiation dosage; repeating for all fields; explaining self care, after-effects, danger signs to pt.; disassembling set-up; recording treatment; having pt. transported; placing records, materials for use.

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Performer sets up any radiotherapy patient and administers external beam radiation therapy to a patient scheduled for treatment of the thorax, such as the lungs, pleura, esophagus, and/or mediastinum.

1. Depending on institutional procedures, performer receives or obtains the patient's treatment chart, the approved treatment plan, consent form, any verification portal films (taken during simulation and/or treatment), accessories to aid in set-up, such as an immobilization device, the patient's treatment record sheet, information on the field dimensions, location(s), and any related medical information such as results of laboratory and other tests.

2. Performer reviews background information on a patient in current treatment, or reads information on a new patient to become familiar with the case. Determines what type of treatment set-up is called for, the patient involved, his or her condition, the area(s) to be treated, the purpose, the equipment involved, any special considerations, and checks the completeness of the information provided. Plans procedure:
   a. Performer notes the patient involved, the condition, and the area(s) to be treated (treatment volumes).

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

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i) Notes the patient's name, identification number, sex, height, weight, and age. Notes the name of the radiotherapist in charge.

ii) Notes whether patient is in-patient, out-patient, to be treated as emergency patient (such as for superior vena cava syndrome).

iii) Notes the type, stage, and location of the tumor, the treatment volume(s), number of fields to be treated.

iv) Notes whether the treatment is the first for the patient,whether there is a change in the treatment plan for a current patient (such as for a booster treatment, reduced field, change as a result of an error being found in treatment geometry), whether treatment is to continue according to current plan. Notes time elapse since last treatment, whether patient has missed treatments.

v) Notes the machine selected for treatment, such as gamma ray megavoltage source using cobalt-60, or megavoltage electron beam or x-ray source (such as betatron or linear accelerator), or a combination for various fields.

vi) Notes whether the approved treatment technique is for radical (curative) or palliative purposes, whether the therapy is to be done in conjunction with other modalities such as surgery, interstitial or intracavitary radiation, and/or chemotherapy. Notes whether radiation therapy is pre-operative, post-operative.

vii) Notes whether treatment verification films are to be made after patient is set up for treatment (as standard quality assurance procedure or as requested). May plan to use the diagnostic x-ray capability of the treatment machine or plans to make "beam film(s)" using the treatment beam as appropriate.

b. If the patient is new or there has been a change in the treatment plan, checks whether physicist or radiotherapist has signed treatment chart indicating that physics plan and dosimetry calculations have been reviewed. May arrange to have calculations made and/or checked as appropriate before proceeding with treatment.

c. For new patient, checks whether consent form is signed and present. If not, may arrange to have radiotherapist talk with patient and/or authorized adult. Does not proceed with treatment until consent form is signed; if necessary, arranges to have patient rescheduled.

d. Performer notes the field locations and arrangements for the treatment, such as stationary fields (parallel opposed, multiple converging, obliquely incident, moving strip fields, wedge fields), or moving fields with arc or rotation.

  i) For stationary fields notes whether the isocenter technique will be used for set-up procedures.

  ii) Notes which portal(s) are scheduled to be treated during the given treatment.

  iii) For rotation therapy may note whether prior rotation was interrupted, and angle at which to begin rotation.

e. Performer reviews the patient's current medical condition in order to provide appropriate preparation and be aware of relevant changes in patient's condition, appearance, or behavior:

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i) Notes results of periodic examinations, including complete blood count and any notes made by the radiotherapist during the last status check. Notes any history of adverse or incipient adverse reaction to radiation, comments on current behavior or emotional state.

ii) Checks whether patient is suffering from a collateral condition requiring special attention in handling, such as heart disease, communicable or infectious condition, infirmity, incoherence, behavioral disorder.

iii) Notes whether patient will have IV drip, oxygen supply, urinary catheter, colostomy, T-tube, or similar device attached, interfering with the patient's mobility.

iv) Notes whether patient will be arriving on stretcher, wheelchair, will be accompanied by nurse, or other staff.

v) Depending on institutional procedures, performer may note whether female patient is pregnant, reviews date of female patient's last menstrual period, or notes any other indication that there is no danger of exposure of a known or possible fetus. If female patient is or may be pregnant, notes what fetus protection must be ensured. Notes any additional protective shielding that may be appropriate.

vi) Notes whether patient may require prior sedation, special immobilization equipment.

vii) Considers whether the condition of the patient and the type of tumor require special nursing services. Notes whether dressing will have to be removed, surfaces cleansed, and/or dressings replaced.

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viii) Considers whether the patient's psychological state must be considered to ensure proper attention to the patient.

ix) Considers whether the patient requires the services of an interpreter.

f. Performer may note and check on any prior preparation and/or concurrent procedures ordered for patient as listed in chart or requisition sheet:

i) Performer may note whether orders for prior nursing preparations have been given and carried out; if not already done, may arrange to have orders carried out or informs appropriate staff member.

ii) If patient's record indicates orders for sedation or any other prior medication, performer may check timing to be sure a proper elapse of time has occurred for medication to take effect. May arrange to delay procedure if appropriate,

iii) If lab tests, clinical care have been ordered to be done prior to treatment, performer checks that these have been carried out and that results are with patient's chart.

iv) If treatment verification portal films are to be made, notes whether procedures to visualize the esophagus are required, such as barium swallow, insertion of a plastic tube in esophagus (with lead beads or BB shots spaced inside the tube). Notes procedure, materials needed, and staff person assigned to insert the tube.

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v) Notes whether a staff person is required to approve placement of wedge filters.

vi) Notes names of other staff members assigned (if any). If appropriate, checks that any staff needed for interpreting, nursing, or other services are present.

g. Performer reviews the treatment plan to be sure he or she understands what is required and to check that all the needed information is present:

i) With regard to the field arrangements, performer notes the number of fields, the locations, the specified size of each, the orientation of each field, any non-regular shapes or beam angulation required, field separation required, which field(s) are to be treated at this time, and in what order, if more than one field will be treated.

ii) If moving strip field technique is involved, performer determines from record of past treatments which combination of strips is to be treated as a field that day, whether anteriorly or posteriorly, and whether any strip is to be added and/or subtracted. Notes whether special strip field-collimators will be used, and size.

iii) For arc or rotation, notes location of the direct field used for set-up, the prescribed degree(s) of rotation, and/or the initial direction for an arc field.

iv) Notes what radiosensitive tissue is to be protected, such as spinal cord, lungs, contralateral lung.

v) Checks the prescribed position of the patient for each treatment field, such as supine, prone, seated erect.

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vi) For wedge field arrangements, notes the wedge angle(s) selected, the orientation of the field(s), the "hinge angle" between fields and the lengths of each field.

vii) Checks the required distance from the source or target to the center of the field (TSD or SSD), or to the tumor (TTD or STD), or from the source to the isocenter axis (SAD) set for center of tumor. For fields that are irregular or not flat, notes where the nominal SSD is to be measured, such as at center of field, at the shortest SSD in the treatment field, at anatomical points such as spinal cord, at mid or upper mediastinum.

viii) Notes what accessories will be used to limit the beam to the area of interest, such as lead beam blocks suspended in shadow tray holder over patient, skip-scan technique with rotation or arc therapy. Notes the angular increments to set on preselector controls for skip-scan technique. Notes whether an extension cone will be used to reduce the beam to a field smaller than the smallest size available with the collimator. Notes the size of the extension cone needed. For posterior blocking through the couch, notes if sandwich blocking technique has been prescribed.

ix) Notes whether an esophagus board will be used to aid with positioning patient in prone position, or whether, for posterior field(s), patient will be treated through the couch.

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x) Notes what beam positioning devices will be used, such as back pointer, pin and arc, side lights, triangulation marks.

xi) Notes the appropriate shielding to be provided to the gonads or to a fetus.

xii) Notes whether filters are to be added to the beam column to affect beam quality.

h. Performer reviews the radiation dosage to be administered to each field to be treated during this particular visit by patient:

i) If betatron or linear accelerator has been prescribed, checks whether x-ray or electron beam modality has been selected.

ii) May review the minimum cumulative tumor dose needed to effect the curative or palliative objective for the treatment plan involved, the maximum dose to be allowed to normal tissue (maximum allowable given dose set by the institution, modified to reflect proximity of tumor to radiosensitive tissues), the number of treatments, and frequency of treatments for each field (fractionation).

iii) Notes the daily given dose for each portal to be treated, whether this is standard dose or result of special calculations.

iv) Notes the dosage to be administered in terms of dosimeter or monitor units or time, depending on the equipment to be used, the portal(s) to be treated, and the type of exposure control to be used.

i. If the performer determines that the treatment plan is not properly authorized, is incomplete, or that

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sufficient information is lacking for performer to set up and administer the treatment, or if missed treatments may warrant review of treatment plan, notifies supervisor, radiotherapist, physicist or other designated staff person, depending on institutional procedures.

i) If performer has any questions about the treatment plan, discusses with appropriate staff person such as radiotherapist.

ii) Proceeds after obtaining information, signature, or orders.

3. When performer is clear about what will be involved in the set-up and treatment, he or she prepares ahead so as not to keep the patient in the treatment room longer than necessary:

a. If performer is not already assigned to a particular treatment room, notes the machine and room assigned and goes there.

b. If using a treatment machine with a diagnostic-type x-ray tube for treatment verification films, makes sure that the alignment of the diagnostic beam with the treatment beam has been checked, or has this done.

c. If using a light system for setting up the treatment field, makes sure that the alignment of the light beam with the radiation beam has been checked, or has this done.

d. Checks that the output of the treatment machine has been calibrated within the prescribed period of time and that the equipment is ready for use.

e. Washes hands as appropriate.

f. Checks that any materials ordered for positioning or immobilizing patient and/or to define the portals or provide for beam direction,

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blocking, or filtering are present, and/or that these were checked and approved during prior simulation or initial set-up.

i) Checks whether esophagus board has been prepared if so ordered.

ii) Checks that customized or standard beam blocks for megavoltage equipment are present. May check for plates marked with diagram of beam block arrangement. May check for gonadal shields.

iii) Checks that appropriate size cones, extenders, filters are present depending on the equipment involved and the field sizes to be set up.

iv) Checks that procedure tray is equipped as appropriate with nursing care materials and set-up materials as appropriate for the treatment plan. Checks that materials are present to reinforce patient markings.

v) If treatment verification film(s) will be made, makes sure than an adequate supply of loaded cassettes of the appropriate types and sizes are available, radiopaque right and left markers, and identification markers.

vi) Checks that treatment table is prepared with clean linens or cover as appropriate. Checks that immobilization devices and supports are available to make patient comfortable.

g. Checks that appropriate attachments are in place on the unit head:

i) May check that accessories are in place, such as collimator holder, tray for beam blocks. If appropriate, obtains tray to hold lead blocks and attaches to accessory ring on unit head at prescribed height, or checks that tray is at prescribed height.

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ii) If an extension cone has been prescribed, performer inserts into cone holder on unit head as appropriate. May attach cone extender.

iii) If appropriate for the equipment, performer may adjust a centimeter scale for the prescribed SSD and insert it into the beam column.

iv) With betatron, depending on whether electron beam or x-ray modality is to be used, checks that appropriate attachments are in place on the unit head, such as collimator holder and beta ionization chamber for electron beam use. May attach appropriate size collimator (for use with electron beam mode) to collimator holder in unit head.

v) For strip field technique, may insert special strip field collimators of prescribed size.

vi) If a filter has been prescribed for use in beam column, checks that appropriate type for the HVL to be achieved is available. May insert in unit head above accessory holder or dials appropriate filter.

h. Prepares treatment table, couch, or chair as appropriate:

i) If treatment table or couch, is not permanently fixed in an isocentric position to the unit head, checks that correct treatment table for the field arrangement prescribed (such as one with open bottom when treatment head is to rotate underneath patient) is in place. If

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not already attached, detaches table currently in place by uncoupling as appropriate. Rolls table away from treatment head; rolls appropriate table into position and attaches as appropriate. If appropriate, slips proper insert into table opening for under-the-table treatment.

- ii) May leave table attached but in uncoupled position if treatment for a stationary field is involved. May move table away if patient is to be treated at floor level on stretcher.
- iii) For arc or rotation, if treatment table is permanently fixed in an isocentric position to the unit head, performer checks that the table is locked in place. If the table is not fixed in an isocentric position, performer couples the unit and table as appropriate. Sets up so that the treatment head is at zero degrees, with the center of the beam at the pendulum axis. Checks that the head of the machine and gantry swivel are at zero degree position. Adjusts if necessary. Checks that treatment table is at zero degrees rotation.
- iv) Checks that side lights, which indicate the isocenter level (axis location) in the horizontal plane, are operative.
- v) If appropriate, slides esophagus board into position on treatment table.
- vi) If anything is missing, arranges to obtain or decides to obtain personally.

i. If treatment verification films will be made, prepares identification marker; obtains loaded cassette or film holder of type appropriate for the equipment, and size appropriate

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for the first field to be treated. Attaches identification information as appropriate and places in position for first field to be treated in cassette tray, tunnel, or in vertical holder.

j. Performer may check that treatment equipment is ready for use:

- i) Checks that safety warning lights are operative above treatment room and control room doors, and that no unauthorized persons are in either room.
- ii) Enters control room and checks that unit is in safe "off" position, and that timer control is at zero or at "off" position.
- iii) For gamma ray teletherapy equipment, makes sure that the source is in a retracted "safe," closed-shutter position, and that the timer switch is on "off" position.
- iv) For betatron or linear accelerator, checks that changeover switch is set for appropriate x-ray treatment beam, or electron beam, or diagnostic x-ray beam modality as appropriate. Checks that necessary warm-up steps have been taken and that machine is ready for use.
- v) Checks intercom and TV monitor.

k. Performer may pre-select settings for arc or rotation therapy.

- i) For rotation therapy performer sets the angle of rotation by setting the "sense" (direction of rotation) switch of the preselection controls at zero. Sets the prescribed angle for rotation. If so indicated, sets the angle at the position listed as where the last treatment ended.

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ii) For arc therapy performer sets the "sense (direction) of rotation" switch to the left or right depending on the direction in which the arc movement is to commence. Sets the prescribed pendulum (arc) angles using the appropriate controls. Checks that indicator shows appropriate reading.

iii) Sets the prescribed rotation speed on the pre-selection control panel.

iv) For skip-scan rotation technique performer sets controls for angular increments over which shutter will be closed. For arc movement performer sets pendulum angles using appropriate controls.

v) Sets pendulum control to "on" or "ready" position to allow pendulum action to start when treatment begins.

1. Performer may set technical factors for verification filming or treatment of the first portal as appropriate. Checks treatment chart.

i) May set appropriate treatment room pre-selection controls.

ii) Sets for appropriate modality if not already done.

iii) For gamma ray modality sets for appropriate time.

iv) For betatron, depending on whether an electron beam (beta ray) or an x-ray beam is to be used, performer selects and sets controls to equalize the field size for the prescribed energy level. Turns on the magnetic field. Checks that proper light goes on and that there is a reading on the amperemeter and the MeV-meter. Sets the prescribed megavoltage. Sets for expansion (and also extraction when beta setting has been chosen).

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v) Sets the radiation controls by choosing the dosimeter setting or the dose rate meter setting as given by the treatment plan.

vi) If a dosimeter is to be used, selects the prescribed dosage by turning the dials until the selected dose in "kicks" or monitor units appears in the indicator windows. Sets the dosimeter at the setting dialed. Connects the counter and checks that its indicators match the dose setting indicators. May also use a timer and set to the estimated time needed to deliver the prescribed dose so that, if machine fails to turn off after dosimeter has registered zero, performer can use time left on timer to estimate dose given to patient.

vii) If a dose rate meter is to be used, sets the dose rate meter to the time prescribed, and sets the dose rate meter sensitivity control in the appropriate time units.

viii) If performer finds any of the controls inoperative, notifies appropriate staff member. Proceeds as ordered.

ix) Performer may depress a re-set button on the control panel. Makes sure that machine is still in "beam off" and/or "shutter closed" position.

4. Performer readies the patient for the set-up and treatment:

a. Performer washes hands as appropriate. Depending on patient's condition and the materials involved, follows appropriate antiseptic and aseptic techniques.

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b. Performer has the patient brought from the holding area and prepared for the treatment (if not already done), or decides to do personally. Depending on institutional arrangements, performer may decide to assit in bringing patient to the treatment room.

c. Performer greets patient and any accompanying staff person and/or family member and introduces self. Checks patient's identity against the requisition sheet. With in-patient, checks hospital identification bracelet or other identifier. Checks with any accompanying staff member on any special precautions necessary during treatment.

d. Performer makes patient comfortable on the table, couch, chair, on stretcher, or as appropriate to the type of treatment planned.

   i) If appropriate, moves treatment table and has patient on stretcher moved into position for treatment.
   ii) If patient is in wheelchair, may move patient in chair into position next to table. Makes sure that wheelchair is in locked position.
   iii) Performer may decide to assist patient to table or has this done. May obtain help. Makes sure that no equipment is in the way that may be collided with by patient. If assisting patient to step on footstool in order to get on table, helps patient turn into position, step backwards on stool, and then sit and/or lie on table. May raise or lower table.
   iv) If patient has a life support system in place, such as respirator, cardiac or infusion equipment, or if patient is under anesthesia, makes sure that this is being monitored.
   v) If there is a wet dressing, performer has it reinforced or decides to do personally.
   vi) Makes sure patient is being attended and there is no danger patient will fall.

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e. If this is the first treatment or a change in the treatment plan, carefully explains to patient and/or family member the set-up procedures and what to expect. Uses language appropriate to patient's level of comprehension.

   i) Explains to patient and/or family member what steps will be carried out, what positions patient will be in, what immobilization devices will be used, what cooperation will be asked of patient.
   ii) Notes that radiation therapy patients may be concerned or frightened about the procedures involved. May explain what radiotherapy is.
   iii) Explains that the external radiation will not make the patient become radioactive, that patient will not be a hazard to anyone.
   iv) Explains that the radiation produces no sensation.
   v) Explains the need for immobilization devices.
   vi) Explains why patient will be in separate room for treatment, how patient remains under observation, and shows how patient can communicate with performer during filming and/or treatment. May practice using inter-communication system.
   vii) Explains equipment in layman's terms if patient is concerned about the massive appearance of equipment.

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viii) Explains how patient can help by remaining perfectly still during the treatment.

ix) If family member is to be allowed to be present with patient during any part of the set-up procedure, makes sure that such a person understands that he or she cannot be present during actual therapy.

x) If appropriate and not already done, performer questions female patient of child bearing age regarding possible pregnancy. If there is any possibility that patient is pregnant, and this has not already been recorded, performer informs radiotherapist in charge at once; proceeds only with approval.

f. If not already done, performer has patient undressed as appropriate for treatment and draped with sheet, if appropriate.

g. Performer attempts to establish a supportive relationship with the patient while preparing for the treatment. If necessary may converse through interpreter.

i) Performer exercises care in reassuring patient while treating patient with dignity and compassion, bearing in mind that patient is suffering from a malignant disease that may be terminal, or with uncertain or poor prognosis. Without being blandly optimistic, performer tries to put patient at ease.

ii) Considers the patient's psychological state, noting that the diagnosis may have been recent. Notes that patient may be frightened or emotionally disturbed, may be incoherent, depressed, withdrawn, bitter, or hostile. Performer attempts to exercise consideration, respect, understanding, and as much warmth as possible. Treats patient with dignity and concern regardless of patient's behavior or age.

iii) Performer is careful to be supportive of patient with respect to the patient's self-concept, body image, and acceptance of the situation that there is a disease condition to be treated or palliated.

iv) If this is the patient's first treatment, performer attempts to develop and maintain a trusting relationship of mutual respect. Makes note of the patient's general appearance, behavior, and emotional affect in order to be aware of any marked changes over the course of the treatment.

h. If treatment is one of a series already started, performer may question patient about any symptoms, discomforts, eating habits, changes in bowel functioning. Makes note of patient's general appearance, behavior, and/or physical condition. Observes and/or asks about relevant indications or symptoms.

i) For esophagus, asks about anticipated reactions such as nausea, vomiting; for esophagus or lungs notes any impairment in speech in latter part of treatment period, checks whether patient is having retrosternal discomfort.

ii) Performer may check for danger signs such as persistent boring pain, high pulse rate, fever, persistent bleeding, failure to gain weight, persistent nausea, breathlessness, persistent dry irritating cough.

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- iii) Checks for behavioral idiosyncrasies, irrational or marked deviations from patient's normal state.
- iv) Performer decides whether patient displays medical or behavioral symptoms which should be brought to radiotherapist's attention before proceeding.
- v) May arrange to have patient given analgesic, anti-nausea pills, diet counseling such as for bland food intake.
- vi) If performer decides to notify radiotherapist, performer is careful to do this so as not to alarm the patient. Performer may call radiotherapist on phone and remain with patient, or may have co-worker remain with patient and may bring patient's treatment chart to radiotherapist. Performer arranges to cancel treatment or continue, based on orders from radiotherapist.
- vii) If analgesic or other medication is prescribed, performer proceeds as appropriate, allowing time for medication to take effect.

i. Performer answers patient's or family member's non-medical questions honestly; attempts to reassure patient and develop confidence.

- i) If performer notes that a patient or patient's family is misinformed about whether the treatment objective is for palliation or for curative care, performer brings this to the attention of the radiotherapist in charge so that the physician can clarify the purpose of the treatment to the patient or family persons involved.
- ii) If questioned about medical prognosis, performer refers patient to his or her attending radiotherapist and indicates that refusal is result of ethical considerations rather than unwillingness to deal with patient. Performer does not lie or invent information.
- iii) Performer discusses the patient's case only with the radiotherapist in charge.

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j. Performer checks patient's treatment markings such as field outlines, areas to be shielded or blocked, entry and exit points, center of beam, beam direction marks, triangulation marks showing center of field and side light positions.

- i) Notes outlines for full fields and strip fields and determines correct field for the given treatment.
- ii) If performer notes that patient markings are fading, reapplies with prepared vegetable dye, using a stick.
- iii) If the markings have been obliterated, arranges to have simulation and set-up procedures repeated.

k. If treatment verification films will be made, performer may have contrast administered to the patient by appropriate staff member, or carries out personally at appropriate point in the procedure:

- i) May assist while radiotherapist inserts tube and BB shot to localize esophagus and/or the level of the tumor within the esophagus.
- ii) May have barium contrast mixture or paste prepared. Administers orally to patient or has this done at proper time.

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5. Performer positions the patient for the first field to be treated. Refers to patient's treatment chart and patient markings;

   a. Places, assists, or has patient assume the appropriate position for the first treatment field, such as lying supine or prone on table or seated in chair. May place arms above head if patient is supine.
   b. May have patient lie prone with chin in chin support on esophagus board. Adjusts board to appropriate angle. Has patient grasp support.
   c. If the treatment plan calls for arc or rotation therapy (or isocenter technique for multiple stationary fields) positions patient on table or chair so that set-up can be done for the direct field that will be used as reference for the moving field (or for the first stationary field). Adjusts and immobilizes patient's arms so that they will not be in the line of the central beam or any moving parts.
   d. May have patient sit erect in chair; may adjust immobilization shell to hold patient in fixed position.
   e. For moving strip technique, positions patient for treatment of the block of strips designated for this day's treatment and for anterior or posterior portal as appropriate.
   f. Is careful not to dislodge any support apparatus such as IV.
   g. May align and center patient using midline markers on table.
   h. If appropriate, turns on sidelights (lights at exactly the same level on either side of room creating a single horizontal light beam at a given height).
   i. Performer applies any appropriate immobilization devices to patient to keep patient in a constant position which is comfortable enough to maintain and appropriate for the tumor type, location, and the equipment to be used.

      i) May use weighted bags, foam rubber pads, head clamp, straps, tape or other devices as prescribed or as deemed necessary May tie down palsied limbs.
      ii) May ask patient about how comfortable the position is and adjust if possible.
      iii) After patient has been immobilized, performer makes sure that patient is still able to make small movements necessary for normal circulation, respiration and other vital functions.

6. Performer sets up for the first treatment field:

   a. For a stationary direct field without isocenter technique, performer adjusts the table and the treatment machine to the source-to-skin distance (SSD) prescribed for the first field being set up.

      i) May use optical distance meter and collimator light system to read SSD. May use centimeter scale set in beam column placed in direct contact with patient's skin.
      ii) Activates the light system. May dim room lights.
      iii) Adjusts the height of the treatment table, patient and/or beam column until the side lights coincide with the lateral patient markings, while the portal remains centered to the central ray, with beam column at zero or 90 degrees.
      iv) For field surfaces that are not flat, performer measures SSD as prescribed, such as from center of field, at shortest possible SSD, or at a level half the dis-

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tance of the spread from the shortest and longest possible SSD in the treatment field, or as ordered.

v) Using distance indicator, or the distance at which the centimeter scale touches the skin, performer adjusts height of beam column and/or table height to the prescribed SSD. Locks into position. Checks distance. Removes centimeter scale.

b. Performer may set up as follows for an obliquely incident beam field:

- i) Unlocks unit head's rotation controls. Rotates head to prescribed angle of incidence. Checks angulation by reading appropriate scale. May use collimator light to adjust beam angulation and SSD until the light cast covers the marked-out field at the prescribed collimator setting.
- ii) If both the entry and exit points have been marked, performer may attach back pointer to accessory ring of beam column and adjust unit head until the tip of the back pointer coincides with the marked poisition of exit of the central ray. Checks that angle obtained is correct.
- iii) If beam directing is needed, if the beam column does not have an angle scale, and if only the entry point is marked, may attach pin and arc device to accessory ring of beam column. Adjusts so that the desired SSD is achieved with the beam column centered on the tumor, following the recorded settings for the pin, arc, and rod, and the angle of entry of the central beam.
- iv) When treatment head is at prescribed angle, locks into position as appropriate.

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c. For isocenter set-up for arc or rotation or as aid to set-up for multiple stationary fields, performer sets up for the prescribed source-to-tumor distance (STD) so that the STD will equal the source-to-axis distance (SAD):

- i) Adjusts table height so that tumor is at the center of rotation at prescribed height. Checks that side lights correspond to markings on patient as described above. Locks table into position.
- ii) Sets the pendulum radius (focal point to pendulum axis) with the machine in the coupled position if appropriate. Moves the treatment head up or down to the prescribed SAD as determined in simulation by reading the appropriate scale. When reached, performer locks into position as appropriate.
- iii) Centers beam column to the center of the field as described above.

d. Performer collimates to the exact field size specified and/or marked on patient so that the light cast from the collimator exactly coincides with the field marked out on the patient. For arc or rotation, collimates to the direct field used as reference. For strip field technique may use special collimator.

- i) Adjusts each collimator dimension until the borders of the light cast coincides with the field outline. May use auxiliary trimmers.
- ii) If the field size is too small for the collimator, performer uses the extension cone that was attached to holder. Checks size by noting whether light

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field cast coincides with field marked on patient.

- iii) When the light field corresponds to the patient's markings, performer checks that the field dimensions shown on collimator controls match the prescribed field dimensions. Locks collimator into position.

e. If the treatment field is irregularly shaped or if the field will be defined with beam blocks as well as collimator, performer may position beam blocks on tray above patient so that the light cast exactly fits the field marked on patient.

- i) Checks that accessory tray (with beam block diagram or plastic plate) is at prescribed height.
- ii) Places standard or custom-made beam blocks of the prescribed HVL on tray in arrangement to coincide with the beam block diagram.
- iii) May insert beam blocks between the two layers of the tray, insert into holder, clamp into position.
- iv) Checks that the shadows cast by the blocks correspond with the areas to be shielded as marked on patient.
- v) For electron beam therapy performer may attach (tape) appropriate beam blocks to collimator. Checks as described above using light system.
- vi) Performer positions beam blocks or places shielding to protect any additional areas within the field such as the contralateral lung, or spinal cord. Places gonadal shielding if appropriate.
- vii) If skip-scan technique is prescribed for arc or rotation technique (in order to protect sensitive tissues by having shutter closed while beam traverses those areas), checks and/or sets angular increments.

f. If wedge filter or wedge pair treatment fields have been prescribed, performer notes the wedge size prescribed for the first field, its angle, the orientation of the thicker end of the wedge, and the angle of incidence to the field.

- i) Selects wedge filter according to size prescribed from wedge selector and inserts in accessory ring, or sets wedge selector on control panel to prescribed number.
- ii) For wedge pair makes sure that heel of wedge is properly placed in relation to second field (at appropriate "hinge angle").
- iii) May check that a pinpoint of light at the thin end of wedge filter is visible on the field and that no strip of light is visible from the beam column on the patient's body.

g. To check set-up and blocking for arc or rotation, may proceed as follows without making exposure:

- i) Checks setting for prescribed degree of rotation and initial direction for arc movement. If peeling technique (off-axis rotation) is prescribed, sets and checks angle at which unit head is tilted.
- ii) Moves all cords or other objects out of the way of the head as it will traverse the rotation field.
- iii) Checks the rotation movement by using control to start; checks pendulum movement by turning

TASK DESCRIPTION SHEET (continued)

Task Code No. 600

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List Elements Fully

pendulum direction control all the way to the left or right as appropriate. Checks whether proper synchronization of table and unit head is accomplished. If not, stops movement using appropriate control and adjusts as needed.

iv) When proper rotation or pendular action is achieved, performer resets knob to left or right pendulum "sense" (direction) as appropriate for arc movement,or to zero for rotation.

v) If performer decides that arc or rotational set-up is satisfactory, performer may switch controls to transfer the control power to control room panel.

h. Performer makes a treatment verification film of the first portal if appropriate. May proceed as follows:

i) If using the treatment machine for double-exposure beam films, may open collimator and make the first exposure including an area surrounding the marked-out field. Makes the second exposure on the same film, collimated to the field outline with beam blocks in place, so that the second exposure indicates the treatment set-up.

ii) If using diagnostic x-ray capability of treatment machine, maintains patient in treatment set-up.

iii) If not already done, places an identified cassette (or film in holder) in cassette holder or tunnel.

iv) Checks or sets the technical factors as appropriate. Makes sure machine is set to the appropriate mode.

v) If not already done, performer centers film (in holder or cassette) to the central beam. For right angle beam entry, centers film to the center of the area of interest and central beam. For obliquely incident beam, centers film to include the entry and exit portals.

vi) If appropriate, makes sure that right or left marker and other identification information will be exposed or recorded on film.

vii) When everything is ready for the exposure, explains to patient what will happen and the importance of holding still during exposure. May have patient practice holding still when requested until told to relax. If appropriate, instructs patient not to swallow during exposure.

viii) Makes sure everyone leaves the room. Explains to patient that performer and other staff are nearby in control room and that patient is under observation.

ix) Performer returns to control room to make exposure. Tells patient when to hold still by calling or using intercom. Initiates exposure by using the appropriate exposure control.

x) Makes sure exposure is terminated as appropriate.

xi) With beam film collimates and positions beam blocks for treatment and makes second exposure as described.

xii) After exposure is completed, tells patient that he or she can relax.

xiii) Removes exposed film in cassette or holder.

xiv) Has film processed at once, placed for processing, or decides to process later personally.

TASK DESCRIPTION SHEET (continued)

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This is page 16 of 20 for this task.

List Elements Fully

i. Throughout the procedure, performer observes the patient for any signs of emergency and/or to prevent or respond to an accident:

- i) Is alert to signs of nausea, dizziness, or sweat, suggesting faintness.
- ii) Notifies nurse or radiotherapist at once.
- iii) If patient shows any emergency signs or has an accident, performer calls appropriate physician or nurse at once.
- iv) May decide to provide emergency first aid as well.
- v) Remains with patient or has staff member remain.
- vi) Tries to make patient as comfortable as possible.

7. Performer administers radiation to the first portal to be treated:

a. When the set-up is completed, performer explains to patient how important it is to remain motionless during treatment.

- i) Explains that patient will be left alone and reviews with patient what signal to use to have performer respond, or how to speak on intercom.
- ii) May review that movement in the machine will occur, what sounds to expect as appropriate.

b. Has everyone in treatment room except patient leave; goes to control booth.

c. If appropriate, such as for electron beam therapy with linear accelerator, may have radiotherapist check patient position and controls.

List Elements Fully

d. Performer makes sure that all controls have been set for first treatment field for correct dosage, or resets as appropriate, as described. Checks that power is on and that timer is at zero or "off" position.

e. Performer observes patient and machine set-up in treatment room through the window of the control booth or on TV monitor. Checks patient's position. Makes sure that only patient is in treatment room. If appropriate, checks indicator lights on pre-selection panel.

f. Performer calls to patient or uses intercom to have patient remain motionless. Initiates the radiation exposure:

- i) For betatron or linear accelerator, uses reset button and activates timer or dosimeter. Checks that warning lights are on.
- ii) For teletherapy cobalt treatment, turns on timer switch and checks for warning lights. Checks that "beam off" indicator is extinguished when shutter reaches "on" position. Checks that timer is operating.
- iii) For arc or rotation, checks indicator lights and motion of equipment to be sure that arc or rotation is proceeding as appropriate.
- iv) If the radiation fails to begin, or if arc or rotation fails to occur, performer may recheck control panel settings to be sure that all accessories are properly selected and exposure factors properly set. Corrects as appropriate or turns off machine and notifies appropriate staff member. Has patient relax.

TASK DESCRIPTION SHEET (continued)

Task Code No. 600

This is page 17 of 20 for this task.

List Elements Fully

g. During the radiation exposure performer constantly monitors the patient and equipment:

  i) Performer observes patient to note any movement of the patient out of the treatment position, any signs of distress or emergency. Notes any call for help from patient.
  ii) Checks that the treatment head is stationary or moving as prescribed.
  iii) Performer observes the control panel and indicators. Checks that dosimeter, counter, or timer is functioning properly. Observes indicators and checks energy level.
  iv) For electron beam therapy with betatron, performer checks the reading on the emission indicator (current of electrons injected into the accelerating tube). May adjust the contraction control setting to deliver optimum radiation. Does not reset energy control while the injection is in progress.

h. If the performer judges that the equipment is not functioning properly, if the patient is in distress, or if the patient moves out of the treatment position, performer turns off the radiation exposure at once:

  i) May open treatment door to activate safety stop; may turn off timer switch; may push stop button; may use emergency stop bar; may use circuit breaker.
  ii) Checks that radiation has ceased and/or that gamma ray source has been returned to a safe position.

List Elements Fully

i. Depending on the patient's condition, performer may provide emergency care as described, obtain help, or reposition patient as appropriate.

  i) May reexplain need for patient to remain still.
  ii) May add immobilization devices.
  iii) May reassure patient, or provide assistance as appropriate.
  iv) May notify radiotherapist of any problem.
  v) If there is a problem with the equipment, performer reassures patient. Has patient relax; informs appropriate staff member of problem with equipment.
  vi) Depending on the situation and any orders, performer may resume treatment after assistance is given or adjustments made, or prepares to terminate.

j. Once any adjustments are made, performer resumes the administration of the treatment. In resetting controls after an interruption in treatment, performer turns power on again as appropriate; depresses the reset button to continue treatment; moves timer switch to "on" position as appropriate. Does not reset timer or dosimeter so that the total actual dose given can be recorded.

k. When the exposure has been terminated, performer checks for audiosignal if appropriate, and that timer switch or dosimeter has reached a zero position or otherwise indicates that the full dose has been administered and that radiation has ceased.

  i) Checks that warning lights are extinguished, and/or that a

TASK DESCRIPTION SHEET (continued)

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List Elements Fully | **List Elements Fully**

"beam off" condition is being signaled.

ii) May move controls to "off" position or first position.

iii) May record final readings on indicators for energy, primary current, dose rate and emission.

iv) If there is any indication that the source has not been fully withdrawn or that x-ray or electron beam radiation has not been terminated, performer tries all alternate or emergency means to terminate.

v) In emergency, may remove patient from treatment room, close door, and notify physicist. With gamma ray source, may attempt to manually move source to a relatively safe position by turning emergency handwheel or inserting emergency "T-bar" and pushing in appropriate direction until indicator shows that source has been retracted or that shutters have been closed.

8. When the prescribed dosage has been administered to the first treatment field, performer checks patient's condition and reviews whether any additional fields are to be treated.

a. If no other field is to be treated, performer proceeds to terminate as described below.

b. If a second treatment field is to be set up, performer may proceed as follows:

i) If the proposed treatment plan calls for a pair of anterior-posterior parallel opposed fields (either direct or with beam at an oblique angle of incidence), and if beam column will not be rotated for an under-the-couch treatment, performer removes the immobilization devices from the patient; has the patient turn over. Assists patient if appropriate, or has co-worker assist. Performer realigns the patient so as to reproduce the reverse of the same field, following the markings laid out on the reverse side.

ii) If the parallel opposed fields are arranged at an oblique angle of incidence, performer uses beam directing devices and/or side lights as described above; refers to markings on the patient.

iii) Adjusts beam column to the prescribed SSD as described, making measurement from the designated area of the field.

iv) With isocenter technique for other fields and for under-the-couch rotation of the treatment head, performer maintains the patient and SAD in position and rotates treatment head to other field positions while maintaining tumor at the center of the central beam, adjusting the table height and beam column as necessary.

v) Sets up second field as described. Collimates to the field area marked out, and sets up beam blocks as prescribed, as described above.

vi) For a second wedge-pair field, performer adjusts the beam column to the required angle of incidence to achieve the prescribed "hinge angle" between the fields, as ordered. Checks second wedge filter as described above. Makes sure to insert second filter so that the heel of the two wedge filters will lie towards each other.

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   - vii) Repeats verification portal filming if appropriate.
   - viii) Repeats all the appropriate set-up steps already described for the first field.

- c. Sets controls and administers dosage to second field as appropriate, as described.
- d. Performer continues as described for any third or more fields to be set up and treated.
- e. If performer considers that patient is in distress, or if performer has any questions or has encountered any problems with the set-up or dosage, discusses with radiotherapist if not already done and continues as ordered.

9. When all fields have been treated, performer returns to the treatment room and checks patient's condition. Moves the beam column out of the way.

   - a. Carefully removes any immobilization devices and replaces in appropriate locations. Makes sure that any devices to be used again by the patient such as shell or esophagus board are identified.
   - b. Performer may discuss with patient what has been done in order to make clear what procedures the patient must follow or continue to follow in order to be properly treated. If appropriate, talks through interpreter, and/or talks with family member accompanying patient:

      - i) Performer explains the importance of retaining the body markings which outline the field area(s). Depending on the material used, indicates or reinforces information on whether washing is prohibited.

List Elements Fully

      - ii) Performer explains any prohibitions on use of cosmetics or toiletries on field area, if appropriate.
      - iii) Performer explains or reinforces procedures to be carried out by patient before treatment as appropriate.

   - c. If institutional policy, performer may answer questions about or inform patient about side effects that can be expected with the treatment, such as retrosternal discomfort, temporary speech impairment, nausea, skin reactions.

      - i) Encourages patient to report persistent nausea, pain, fever, bleeding, breathlessness, cough, changes in eating habits, fluid intake and output, or bowel movements to the radiotherapist or nurse so that these can be noted and help provided.
      - ii) If not already done, may arrange to have a check list prepared and given to patient or family member to reinforce the instructions.

   - d. Performer notes next location for which patient is scheduled, such as recovery area, scheduling for next treatment, back to room, or whether patient is to return home.

      - i) May decide to assist patient to leave; may decide to transport personally; or may have this done.
      - ii) Makes sure that none of the equipment is projecting over the patient before allowing patient to rise.
      - iii) May have patient transported to recovery area to rest until im-

TASK DESCRIPTION SHEET (continued)

Task Code No. 600

This is page 20 of 20 for this task.

List Elements Fully

mediate effects of procedure and any medication have abated.

- iv) If appropriate, makes sure that patient is in the care of a staff person who will transport to appropriate next location or, if out-patient, will arrange to discharge or send patient home (with family member or escort if appropriate).

e. Performer removes the attachments inserted in the beam column and places in appropriate location(s). Checks that all custom-made devices are identified and accounted for.

f. Makes sure that any treatment verification portal films are identified with patient identification information and with indications of the views involved. May include patient's name and number, physician's name, date, type of film, machine number.

g. May have room and equipment cleaned; has any other appropriate clean up procedures followed to avoid infection or contamination, or decides to do personally, depending on institutional procedures.

h. Performer records the treatment delivered according to institutional procedures.

- i) Records date, time if appropriate, the number of the treatment, and the number of days since the last treatment, as appropriate.
- ii) Records the field reference for each field, such as its name and number. Records the treatment machine type (and identification number if appropriate).
- iii) If moving strip field has been involved, performer may record the strips which were treated and whether anteriorly or posteriorly on special chart.

List Elements Fully

- iv) If appropriate, performer may record angle position at which rotation of machine was stopped (as shown on scale on unit head) on patient's treatment chart so that next treatment can begin from that position.
- v) Records the prescribed dose, the given dose and the cumulative dose.
- vi) May calculate and record the skin dose and/or the maximum dose on the central axis (applied dose). May calculate and record the cumulative applied dose. Uses appropriate formulae and information supplied in treatment plan.
- vii) Records any appropriate related information such as whether verification films were taken, whether treatment was interrupted, any problems encountered, what was done or decided. Records any unuusual behavior or symptoms of patient.
- viii) If the treatment is the first or at an appropriate stage in the plan, performer may mark the treatment chart or folder to initiate a check or a review of dosimetry calculations.
- ix) Signs chart as appropriate.

i. Places all documents for logging, further processing, or filing, as appropriate.

j. May indicate to appropriate staff person when the performer is ready to proceed with next set-up and treatment.

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
This is page 1 of 3 for this task.

Code 601

Performer's Name____________________ **Analyst(s)**____________________ **Dept.**__________
Job Title____________________ **Institution**____________________ **Date**__________

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Patient set up for external beam radiation therapy; treatment dosage administered; patient's condition noted and/or reported; treatment recorded; patient reassured, given explanation, instructions; materials, records placed for use; patient sent or escorted to next location.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt.'s radiotherapy treatment plan,requisition sheet, ID card,bracelet,medical-technical chart,prior radiographs,scans;view boxes;external beam treatment machine,controls,intercom;distance,beam angle indicators;table;light system;collimator;beam accessory holder;blocking tray;split beam auxiliary collimator or applicator;rolling ball inclinometer;support bar, grid;compression breast bridges;bolus;rice bags;arm board;scales,rulers;x-ray film,holders;cassettes; cassette holder;immobilization devices;breast board; shielding;radiopaque ID markers;beam blocks;beam direction device,pin and arc,back pointer;side lights; beam block diagram plate;tape,scissors;dye,ink, sticks;pen,pencil;pt.instructions;stretcher,wheelchair;forms;soap,water;calipers

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Any radiotherapy patient;radiotherapist;co-worker; family member;nurse

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Setting up any radiotherapy patient and administering external beam radiation therapy to the breast(s) by reviewing treatment plan;preparing equipment and materials;reassuring,attending to pt.'s condition;noting,reporting danger signs to radiotherapist;positioning,immobilizing pt.for treatment;setting up direct,tangential parallel opposed or oblique treatment fields using isocentric or rolling ball inclinometer technique;setting up blocking for tissues to be spared;making verification film;setting controls for prescribed dosage;administering radiation dosage; repeating for all fields;explaining self care,aftereffects,danger signs to pt.;disassembling set-up;recording treatment;having pt.transported;placing records,materials for use.

List Elements

Performer sets up any radiotherapy patient and administers external beam radiation therapy for a patient scheduled for treatment of the breast(s).

1. General initial steps include finding out what treatment is scheduled, the patient involved, the treatment plan, relevant history and circumstances, the attending radiotherapist and other staff involved, and specific information on the treatment for the day.
   a. Reviews background information on new or ongoing radiotherapy patient.
   b. Determines treatment set-up, patient's condition, purpose of treatment, the equipment ordered, special considerations, and checks that all information is complete.
   c. Checks whether treatment verification films will be required, whether dosimetry calculations have been reviewed, whether consent form has been signed, whether all clinical or lab information is present.
   d. Reviews details of set-up for the day, the fields to be treated, location, dimensions, accessories. Reviews treatment geometry and prescribed dosage.

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
Code 601 This is page 2 of 3 for this task.

Performer's Name ________________ Analyst(s) ________________ Dept. ________
Job Title ________________ Institution ________________ Date ________

List Elements

2. This task is similar to Task Code 600 in the following general areas:

   a. Prepares materials and equipment ahead. Sets up accessories; checks that prior nursing services, safety check of equipment have been carried out. Checks for presence of all materials and equipment. If appropriate, sets controls for dosage for first field to be treated or for filming. Checks intercom and TV monitor.
   b. Greets and readies patient for set-up and treatment. Checks patient's condition and is supportive. Reports any danger signs to radiotherapist. Explains what will be done. Reinforces fading patient markings.
   c. Positions patient for first treatment field using triangulation marks.
   d. Adjusts beam angulation. May use beam direction equipment if necessary. Adjusts SSD with distance indicator or adjusts SAD using isocenter technique.
   e. Collimates to field using light system and patient markings. Applies beam blocking, tissue compensators, filtration, shielding as appropriate. Immobilizes patient.
   f. Makes treatment verification films if appropriate.
   g. Checks or sets radiation settings and controls. Administers radiation while observing patient and equipment. Responds to patient movement or emergency as appropriate.
   h. Continues with any other treatment fields.
   i. Disassembles treatment set-up. Explains self-care to patient, normal reactions to treatment, and danger signs to report.
   j. Sees that patient is taken to appropriate next location.
   k. Records treatment as appropriate, including given and cumulative dose, skin or applied dose. May calculate.

List Elements

   l. Returns custom-made accessories, records as appropriate.

3. Unique features of this task are as follows:

   a. Treatment fields may include chest wall and regional nodes in the internal mammary region, axillary region, and supraclavicular region on the ipsilateral side. Notes whether bilateral or unilateral treatment is involved.
   b. Field arrangements include direct field(s), medial and lateral (parallel opposed) tangential chest wall fields, non-parallel opposed tangential fields. Mastectomy scar may be included in treatment field.
   c. Equipment can include megavoltage electron beam therapy, such as linear accelerator, betatron, and/or cobalt-60 teletherapy.
   d. Set-up techniques include use of isocenter or rotation mechanism and/or a rolling ball inclinometer to measure the separation and angles of tangential fields.

      i) Set-up equipment may include, in addition, any or all of the following: breast board, bar to immobilize breast, support grid (if bolus is not used), tangential compression breast bridge plates.
      ii) If a bolus is to be used to bring the depth dose to the surface for chest wall tangential fields, checks whether bolus will be used on this particular day (treatment plan may specify a given frequency of use of bolus).
      iii) In setting up beam blocks for internal mammary and medial tangential fields, notes what blocking is to be used on this

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
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Performer's Name___________ **Analyst(s)**___________ **Dept.**_______
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List Elements	List Elements

particular day so that overlapping of adjacent borders of fields can be compensated to provide homogeneous dose.

- iv) For tangential fields, performer uses a special breast cone applicator or auxiliary collimator to provide use of split beam technique to eliminate penumbra and divergence and to spare healthy tissues.

e. Positioning of patient may be as follows:

- i) For chest wall, anterior axillary and supraclavicular fields, has patient assume supine position on table, with head turned to the contralateral side. Does not use pillows unless convexity of upper chest is extreme. Abducts upper arm 90°. Supports forearm in upright position with vertical arm board.
- ii) For posterior axillary field, has patient assume prone position with head turned to the contralateral side, with forearm rotated down, the shoulder in contact with the table top, and back of hand on pelvic brim. Does not use pillows.

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
Code 602 This is page 1 of 3 for this task.

Performer's Name ____________ Analyst(s) ____________ Dept. ________
Job Title ____________ Institution ____________ Date ________

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Patient set up for external beam radiation therapy; treatment dosage administered; patient's condition noted and/or reported; treatment recorded; patient reassured, given explanation, instructions; materials,records placed for use;patient sent or escorted to next location.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt.'s radiotherapy treatment plan,requisition sheet, ID card,bracelet,medical-technical chart,prior radiographs,scans;view boxes;external beam treatment machine,controls,intercom;distance,beam angle indicators;table;light system;collimator;beam accessory holder;blocking tray;mantle board;scales,rulers; x-ray film,holders,cassettes;compensatory filter;immobilization devices;radiopaque ID markers;beam blocks;blocking bridge;male gonadal shielding;side lights;beam block diagram plate;tape,scissors;dye, ink,sticks;pen,pencil;pt.instructions;stretcher, wheelchair;forms;soap,water;calipers

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Any radiotherapy patient;radiotherapist;co-worker; family member;nurse

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Setting up any radiotherapy patient and administering external beam radiation therapy to the lymph nodes with mantle and/or "inverted-Y" field techniques or variations by reviewing treatment plan;preparing equipment and materials;reassuring,attending to pt.'s condition;noting,reporting danger signs to radiotherapist;positioning,immobilizing pt.for treatment;setting up anterior mantle,"inverted-Y", or component fields,parallel opposed fields using SSD or isocenter technique;setting up beam blocking,compensatory filtration,gonadal shielding;making verification films;setting controls for prescribed dosage; administering radiation dosage;repeating for all fields;explaining self care,after-effects,danger signs to pt,;disassembling set-up;recording treatment;having pt.transported;placing records,materials for use.

List Elements

Performer sets up and administers external beam radiation therapy for a scheduled treatment of a patient's lymph nodes with "mantle" and/or "inverted-Y" technique (treatment of all major lymph nodes above and/or below the diaphragm; i.e.,total nodal irradiation, including the lymph node chains above the diaphragm and/or the para-aortic, spleen,or spleen pedicle, pelvic, inguinal femoral regions), or a variation.

1. General initial steps include finding out what treatment is scheduled, the patient involved, the treatment plan, relevant history and circumstances, the attending radiotherapist and other staff involved, and specific information on the treatment for the day.

   a. Reviews background information on new or ongoing radiotherapy patient.
   b. Determines treatment set-up, patient's condition, purpose of the treatment, the equipment ordered, special considerations, and checks that all information is complete.
   c. Checks whether treatment verification films will be required, whether dosimetry calculations have been reviewed, whether consent form has been signed, whether all clinical or lab information is present.

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.

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Performer's Name__________ Analyst(s)__________ Dept.______

Job Title__________ Institution__________ Date______

List Elements

d. Reviews details of set-up for the day, the fields to be treated, location, dimensions, accessories. Reviews treatment geometry and prescribed dosage.

2. This task is similar to Task Code 600 in the following general areas:

   a. Prepares materials and equipment ahead. Sets up accessories; checks that prior nursing services, safety check of equipment have been carried out. Checks for presence of all materials and equipment. If appropriate, sets controls for dosage for first field to be treated or for filming. Checks intercom and TV monitor.
   b. Greets and readies patient for set-up and treatment. Checks patient's condition and is supportive. Reports danger signs, missed appointments to radiotherapist. Explains to patient what will be done. Reinforces fading patient markings.
   c. Positions patient for first treatment field using triangulation marks.
   d. Adjusts beam angulation. May use beam direction equipment if necessary. Adjusts SSD with distance indicator or adjusts SAD using isocenter technique.
   e. Collimates to field using light system and patient markings. Applies beam blocking, tissue compensators, filtration, shielding as appropriate. Immobilizes patient.
   f. Makes treatment verification films if appropriate.
   g. Checks or sets radiation settings and controls. Administers radiation while observing patient and equipment. Responds to patient movement or emergency as appropriate.
   h. Continues with any other treatment fields.
   i. Disassembles treatment set-up. Explains self-care to patient, normal reactions to treatment and danger signs to report.
   j. Sees that patient is taken to appropriate next location.
   k. Records treatment as appropriate, including given and cumulative dose, skin or applied dose. May calculate.
   l. Returns custom-made accessories, records as appropriate.

3. Unique features of this task are as follows:

   a. Checks that appropriate clinical and lab tests such as blood studies have been carried out.
   b. Reviews the field arrangements prescribed, such as mantle, inverted-Y field, individual aortic and pelvic fields, whether parallel opposed or modified posterior mediastinal field, whether splenic bed is included in inverted-Y field, whether a small posterior portal is to be used for spleen.
   c. Notes equipment to be used, such as linear accelerator, betatron, cobalt-60 megavoltage. Notes whether patient will be maintained in supine position and isocenter technique will be used to treat posterior fields from under the table (with treatment head rotated).
   d. Notes areas to be blocked and/or shielded, such as cerebellum, larynx, trachea, heart-lungs, and humeral heads for mantle fields; spinal cord for posterior fields; kidney(s), liver, normal tissue, surgically transposed ovaries, testicles, for inverted-Y fields or modifications.

      i) If a mantle board is to be used for positioning, checks that it is ready.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 3 of 3 for this task.

Code 602

Performer's Name ____________________ Analyst(s) ____________________ Dept. __________
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List Elements	List Elements
ii) Notes type of blocking and shielding to be used, such as styrofoam molds filled with lead for lung blocks, use of lead, beam-shaping shadow tray blocks, and/or appropriate shielding for testicles, bridge with lead bricks for protection from any leakage. iii) Notes whether different lung blocks are to be used to provide shielding for anterior and posterior fields. e. Notes whether custom-made compensatory filters are to be used in treatment to achieve dose homogeneity. f. If treatment verification portal films are to be made, performer may arrange for injection of radiopaque iodine-based contrast to make kidneys visible on portal films. May instruct patient in need to breathe shallowly and hold as still as possible during filming and/or treatment. g. For mantle field may attach mantle board to treatment table in correct position. Positions patient for anterior mantle portal in supine position, with head extended and immobilized in precise, predetermined position. Adjusts arms, chin and head with positioning guides. h. Positions machine as appropriate and sets up beam blocks, molded lung blocks and/or compensatory filter. Makes sure to provide shielding for testicles, beam blocks for transposed ovaries.	

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
This is page 1 of 3 for this task.

Code 603

Performer's Name ____________________ **Analyst(s)** ____________________ **Dept.** __________
Job Title ____________________ **Institution** ____________________ **Date** __________

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Patient set up for external beam radiation therapy; treatment dosage administered; patient's condition noted and/or reported; treatment recorded;patient reassured,given explanation,instructions;materials,records placed for use;patient sent or escorted to next location.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt.'s radiotherapy treatment plan,requisition sheet, ID card,bracelet,medical-technical chart,prior radiographs,scans;view boxes;external beam treatment machine,controls;intercom;distance,beam angle indicators;table;light system;collimator;beam accessory holder;blocking tray;scales,rulers;x-ray film,holders,cassettes,cassette holder;immobilization devices; air insufflators;procedure tray;cervical localizer, vaginal probe;catheters;barium enema;lateral field bridge;strip filed collimators;beam block diagram plate;radiopaque ID markers;beam blocks;beam direction device,pin and arc,back pointer;side lights; tape;scissors;dye,ink,sticks;pen,pencil;pt. instructions;stretcher,wheelchair;forms;soap;water

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(x) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Any radiotherapy patient;radiotherapist;co-worker; family member;nurse

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Setting up and administering external beam radiation therapy to whole abdomen of radiotherapy patient or female patient to receive external beam radiation of the reproductive system by reviewing treatment plan; preparing equipment and materials;reassuring,attending to pt.'s condition;noting,reporting danger signs to radiotherapist;positioning, immobilizing pt. for treatment;setting up direct,parallel opposed,isocentric,arc or rotation,or moving strip treatment fields;setting up beam blocks;making verification films;setting controls for prescribed dosage;administering radiation dosage;repeating for all fields;explaining self care,after-effects,danger signs to pt.; disassembling set-up;recording treatment;having pt. transported;placing records,materials for use.

List Elements

Performer sets up and administers external beam radiation therapy scheduled for the whole abdomen of any patient,or scheduled for treatment of a female patient's whole abdomen, pelvis, lower pelvis, or lateral pelvic structures and regional lymph nodes. (Center areas may be blocked to reduce the dose to the bladder and rectum when the central strip is treated with intracavitary radiation.)

1. General initial steps include finding out what treatment is scheduled, the patient involved, the treatment plan, relevant history and circumstances, the attending radiotherapist and other staff involved, and specific information on the treatment for the day.
   - a. Reviews background information on new or ongoing radiotherapy patient.
   - b. Determines treatment set-up, patient's condition, purpose of the treatment, the equipment ordered, special considerations, and checks that all information is complete.
   - c. Checks whether treatment verification films will be required, whether dosimetry calculations have been reviewed, whether consent form has been signed, whether all clinical or lab information is present.

OK-RP;RR;RR

6. Check here if this is a master sheet..(x)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 2 of 3 for this task.

Code 603

Performer's Name ____________________ Analyst(s) ____________________ Dept. __________
Job Title ____________________ Institution ____________________ Date __________

List Elements

d. Reviews details of set-up for the day, the fields to be treated, location, dimensions, accessories. Reviews treatment geometry and prescribed dosage.

2. This task is similar to Task Code 600 in the following general areas:

   a. Prepares materials and equipment ahead. Sets up accessories; checks that prior nursing services, safety check of equipment have been made. Checks intercom and TV monitor; checks that all materials needed are present. May set controls for dosage for first field to be treated or for filming.
   b. Greets and readies patient for set-up and treatment. Checks patient's condition and is supportive. Reports danger signs, missed appointments to radiotherapist. Explains to patient what will be done. Reinforces fading patient markings.
   c. Positions patient for first treatment field using triangulation marks. Sets up for moving strip technique if so ordered and checks which strips are to be treated at this time, and whether anteriorly or posteriorly.
   d. Adjusts beam angulation. May use beam direction equipment if necessary. Adjusts SSD with distance indicator or adjusts SAD using isocenter technique.
   e. Collimates to field using light system and patient markings. Applies beam blocking, tissue compensators, filtration, shielding as appropriate. Immobilizes patient.
   f. Sets up for arc or rotation if so ordered and checks functioning of set-up before exposure.
   g. Makes treatment verification films if appropriate.
   h. Checks or sets radiation settings and controls. Administers radiation while observing patient and equipment. Responds to patient movement or emergency as appropriate.
   i. Continues with any other treatment fields.
   j. Disassembles treatment set-up.
   k. Explains self-care to patient, normal reactions to treatment and danger signs to report.
   l. Sees that patient is taken to appropriate next location.
   m. Records treatment as appropriate, including given and cumulative dose, skin or applied dose. May calculate.
   n. Returns custom-made accessories, records as appropriate.

3. Unique features of this task are as follows:

   a. If treatment verification portal films are to be made, checks that staff to assist or direct set-up procedures, catheterize patient, insert vaginal probe, inject contrast, or administer enema are ready or available.
   b. Performer reviews the field locations and arrangements such as parallel opposed abdominal and/or pelvic fields, four-field technique, moving strip technique, direct fields, or arc or rotational technique.
   c. Notes equipment to be used, such as linear accelerator, betatron, cobalt-60 megavoltage. Notes whether special collimator will be used with moving strip technique. If so, notes strip sizes to be used.
   d. Checks the areas to be blocked, such as kidneys (in posterior field), liver, corners of field, central areas (such as strip including bladder, rectum, vagina, cervix).
   e. For treatment verification films notes the areas to be visualized with special procedures, such as

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 3 of 3 for this task.

Code 603

Performer's Name ______________ Analyst(s) ______________ Dept. ________
Job Title ______________ Institution ______________ Date ________

List Elements	List Elements
use of radiopaque calibrated cervical localizers or metal vaginal probe, catheterization of urethra with air insufflator and contrast solution to outline bladder, catheterization of rectum and/or instillation of barium enema, intravenous injection of iodine-based contrast to visualize kidneys. i) May assist in insertion of vaginal or cervical localizer. ii) May assist with catheterization, instillation of barium in colon, injection of iodine-based contrast. iii) May instruct patient in how to breathe shallowly and hold still during filming and/or treatment. f. Sets up treatment field. May use a bridge to set up lateral fields. Lays out strip fields if appropriate using special collimator. g. Sets up beam blocking as appropriate. h. When all fields scheduled have been treated, has probes, catheter, enema removed, or decides to do personally.	

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
Code 604
This is page 1 of 3 for this task.

Performer's Name ____________ **Analyst(s)** ____________ **Dept.** ________
Job Title ____________ **Institution** ____________ **Date** ________

1. **What is the output of this task?** (Be sure this is broad enough to be repeatable.)

Patient set up for external beam radiation therapy; treatment dosage administered;patient's condition noted and/or reported;treatment recorded;patient reassured,given explanation,instructions;materials, records placed for use;patient sent or escorted to next location.

2. **What is used in performing this task?** (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt.'s treatment plan,requisition sheet, ID card, bracelet,medical-technical chart,prior radiographs scans;view boxes;external beam treatment machine, controls;intercom;distance,beam angle indicators; table;light system;collimator;beam accessory holder; blocking tray;scales,rulers;x-ray film,holders,cassettes; cassette holder;immobilization devices; air insufflators;catheterization sterile procedure tray; barium enema materials;contrast media;syringes;beam block diagram plate;radiopaque ID markers;beam blocks;beam direction device,pin and arc,back pointer;side lights;tape;scissors;dye,ink,sticks;pen,pencil;pt.instructions;stretcher,wheelchair;forms;soap; water;bolus bag;wedge filters

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved.

Any radiotherapy patient;radiotherapist;co-worker; physicist;family member;nurse

5. **Name the task** so that the answers to questions 1-4 are reflected. Underline essential words.

Setting up and administering external beam radiation therapy to the whole pelvis or urinary bladder of a radiotherapy pt. or male pt. to receive external beam radiation of the prostate, by reviewing treatment plan;preparing equipment and materials;reassuring,attending to pt.'s condition;noting,reporting danger signs to radiotherapist;positioning,immobilizing pt.for treatment;setting up parallel opposed direct or oblique fields,multiple converging,or anterior oblique wedge fields,using prescribed SSD or arc or rotation isocenter technique;setting up beam blocks;making verification films;setting controls for prescribed dosage;administering radiation dosage; repeating for all fields;explaining self care,aftereffects,danger signs to pt.;disassembling set-up;recording treatment;having pt. transported;placing records,materials for use.

List Elements

Performer sets up and administers external beam radiation therapy scheduled for the whole pelvis or urinary bladder of any patient, or scheduled for a male patient's prostate.

1. General initial steps include finding out what treatment is scheduled, the patient involved, the treatment plan, relevant history and circumstances, the attending radiotherapist and other staff involved, and specific information on the treatment for the day.
   a. Reviews background information on new or ongoing radiotherapy patient.
   b. Determines treatment set-up, patient's condition, purpose of the treatment, the equipment ordered, special considerations, and checks that all information is complete.
   c. Checks whether treatment verification films will be required, whether dosimetery calculations have been reviewed, whether consent form has been signed, whether all clinical or lab information is present.
   d. Reviews details of set-up for the day, the fields to be treated, location, dimensions, accessories. Reviews treatment geometry, and prescribed dosage.

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 2 of 3 for this task.

Code 604

Performer's Name____________________ **Analyst(s)**____________________ **Dept.**________
Job Title____________________ **Institution**____________________ **Date**________

List Elements

2. This task is similar to Task Code 600 in the following general areas:

   a. Prepares materials and equipment ahead. Sets up accessories; checks that prior nursing services, safety check of equipment have been carried out. Checks for presence of all materials and equipment. If appropriate, sets controls for dosage for first field to be treated or for filming. Checks intercom and TV monitor.
   b. Greets and readies patient for set-up and treatment. Checks patient's condition and is supportive. Reports danger signs, missed appointments to radiotherapist. Explains to patient what will be done. Reinforces fading patient markings.
   c. Positions patient for first treatment field using triangulation marks.
   d. Adjusts beam angulation. May use beam direction equipment if necessary. Adjusts SSD with distance indicator or adjusts SAD using isocenter technique.
   e. Collimates to field using light system and patient markings. Applies beam blocking, bolus or tissue compensators. Sets up and checks wedge filter. Immobilizes patient.
   f. Sets up for arc or rotation if so ordered and checks functioning of set-up before exposure.
   g. Makes treatment verification films if appropriate.
   h. Checks or sets radiation settings and controls. Administers radiation while observing patient and equipment. Responds to patient movement or emergency as appropriate.
   i. Continues with any other treatment fields.
   j. Disassembles treatment set-up.
   k. Explains self-care to patient, normal reactions to treatment and danger signs to report.
   l. Sees that patient is taken to appropriate next location.

List Elements

   m. Records treatment as appropriate, including given and cumulative dose, skin or applied dose. May calculate.
   n. Returns custom-made accessories, records as appropriate.

3. Unique features of this task are as follows:

   a. If treatment verification portal films are to be made, checks that staff to assist or direct set-up procedures, catheterize patient, insert enema tip, instill contrast and administer enema are ready or available.
   b. Performer reviews the locations to be treated, such as total pelvis (sparing the rectum as much as possible), total bladder, selected areas of involvement (sparing as much of bladder and rectum as possible).

      i) Reviews field arrangements such as lateral arc or rotational moving fields, or stationary fields such as parallel opposed direct or oblique fields, multiple converging fields, anterior oblique wedge fields.
      ii) Notes whether the field to be treated at this time is a larger pelvic field or an already-marked reduced field (such as in late stage of therapy). Reviews simulation records.
      iii) Notes whether patient is to be treated in supine and/or prone position.

   c. Checks equipment to be used, such as linear accelerator, betatron, cobalt-60 megavoltage.
   d. If appropriate for treatment verification films, assists or arranges to have patient's urethra catheter-

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 3 of 3 for this task.

Code 604

Performer's Name____________________ **Analyst(s)**____________________ **Dept.**__________
Job Title____________________ **Institution**____________________ **Date**__________

List Elements	List Elements
ized with Foley catheter, and enema tip or second catheter inserted in rectum. Follows aseptic procedures as appropriate. Assists with instillation of contrast. e. Sets up treatment field(s) with patient in supine and/or prone position as appropriate. Sets up beam blocks. f. Carries out procedures to set up wedge filters for anterior oblique wedge fields if appropriate. g. At end of procedure has any balloon catheters emptied; has catheter, enema removed, or does personally, following aseptic technique.	

TASK IDENTIFICATION SUMMARY SHEET

This is task __ of __ for this performer.
Code 605
This is page 1 of 3 for this task.

Performer's Name____________ **Analyst(s)**____________ **Dept.**________
Job Title____________ **Institution**____________ **Date**________

1. **What is the output of this task?** (Be sure this is broad enough to be repeatable.)

Patient set up for external beam radiation therapy; treatment dosage administered;patient's condition noted and/or reported;treatment recorded;patient reassured,given explanation,instructions;materials,records placed for use;patient sent or escorted to next location.

2. **What is used in performing this task?** (Note if **only** certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt.'s radiotherapy treatment plan,requisition sheet, ID card,bracelet,medical-technical chart,prior radiographs,scans;view boxes;external beam treatment machine,controls;intercom;distance,beam angle indicators;table;light system;collimator;beam accessory holder;blocking tray;scales;x-ray film,holders, cassettes;cassette holder;immobilization devices;bolus; procedure tray;testicle shielding or positioning device;beam block diagram plate;radiopaque ID markers; beam blocks;beam direction device,pin and arc,back pointer;side lights;tape;scissors;dye,ink,sticks; pen,pencil;pt.instructions;stretcher,wheelchair; forms;soap;water

3. **Is there a recipient, respondent or co-worker involved in the task?** Yes...(x) No...( )

4. **If "Yes" to q. 3:** Name the **kind** of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Male radiotherapy patient;radiotherapist;co-worker; family member;nurse

5. **Name the task** so that the answers to questions 1-4 are reflected. Underline essential words.

Setting up a male radiotherapy patient and administering external beam radiation therapy to the testis by reviewing treatment plan;preparing equipment and materials;reassuring,attending to pt.'s condition; noting,reporting danger signs to radiotherapist;positioning,immobilizing pt.for treatment;setting up anterior,posterior parallel opposed "inverted T" or "L-shaped" fields at correct SSD;blocking and/or excluding remaining testis and part of scrotum as ordered;making verification films;setting controls for prescribed dosage;administering radiation dosage; repeating for all fields;explaining self care,aftereffects,danger signs to pt.;disassembling set-up;recording treatment;having pt. transported;placing records,materials for use.

List Elements Fully

Performer sets up and administers external beam radiation therapy to a male patient scheduled to receive radiation treatment of the testis.

1. General initial steps include finding out what treatment is scheduled, the patient involved, the treatment plan, relevant history and circumstances, the attending radiotherapist and other staff involved, and specific information on the treatment for the day.
   a. Reviews background information on new or ongoing radiotherapy patient.
   b. Determines treatment set-up, patient's condition, purpose of treatment, the equipment ordered, special considerations, and checks that all information is complete.
   c. Checks whether treatment verification films will be required, whether dosimetry calculations have been reviewed, whether consent form has been signed, whether all clinical or lab information is present.
   d. Reviews details of set-up for the day, the fields to be treated, location, dimensions, accessories. Reviews treatment geometry, prescribed dosage.
2. This task is similar to Task Code 600 in the following general areas:

OK-RP;RR;RR

6. **Check here if this is a master sheet..(X)**

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 2 of 3 for this task.

Code 605

Performer's Name__________ **Analyst(s)**__________ **Dept.**______
Job Title__________ **Institution**__________ **Date**______

List Elements

a. Prepares materials and equipment ahead. Sets up accessories; checks that prior nursing services, safety check of equipment have been carried out. Checks for presence of all materials and equipment. If appropriate, sets controls for dosage for first field to be treated or for filming. Checks intercom and TV monitor.
b. Greets and readies patient for set-up and treatment. Checks patient's condition and is supportive. Reports danger signs, missed appointments to radiotherapist. Explains to patient what will be done. Reinforces fading patient markings.
c. Positions patient for first treatment field using triangulation marks.
d. Adjusts beam angulation. May use beam direction equipment if necessary. Adjusts SSD with distance indicator or adjusts SAD using ioscenter technique.
e. Collimates to field using light system and patient markings. Applies beam blocking, tissue compensators, filtration, shielding as appropriate. Immobilizes patient.
f. Makes treatment verification films if appropriate.
g. Checks or sets radiation settings and controls. Administers radiation while observing patient and equipment. Responds to patient movement or emergency as appropriate.
h. Continues with any other treatment fields.
i. Disassembles treatment set-up.
j. Explains self-care to patient, normal reactions to treatment and danger signs to report.
k. Sees that patient is taken to appropriate next location.
l. Records treatment as appropriate, including given and cumulative dose, skin or applied dose. May calculate.
m. Returns custom-made accessories, records as appropriate.

List Elements

3. Unique features of this task are as follows:

   a. Performer reviews the areas to be treated and the field arrangements.

      i) Notes whether tumor area is unilateral, and side on which orchiectomy has been done.
      ii) Notes whether parallel opposed, anterior and posterior L-shaped or T-shaped fields are prescribed, and notes boundaries marked.
      iii) Notes whether the treatment volume is to be irradiated by single anterior or posterior fields or by subdivided fields. Notes the prescribed SSD (adjusted to include the required field length). Notes beam block arrangement to be used to shape the field.
      iv) Notes whether remaining testis is to be irradiated or shielded, whether scrotum and/or portion of scrotum is to be included in treatment field.
      v) Performer notes what type of equipment will be used to shield the remaining testicle, such as hemispherical lead shields, lucite holder to isolate testicle from central beam (while irradiating portion of scrotum if appropriate). Performer may position bolus.

   b. Checks equipment to be used, such as cobalt-60 or other megavoltage equipment.
   c. Performer sets up field. Positions beam blocks. May position an isolating or shielding device to keep the remaining testicle and any portion of scrotum to be blocked out of beam.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.

Code 605

This is page 3 of 3 for this task.

Performer's Name	Analyst(s)	Dept.
Job Title	Institution	Date

List Elements	List Elements
d. After treating anterior field(s) continues as appropriate for parallel opposed or modified posterior field(s).	

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
This is page 1 of 2 for this task.

Code 606

Performer's Name ____________ **Analyst(s)** ____________ **Dept.** ________
Job Title ____________ **Institution** ____________ **Date** ________

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Patient set up for external beam radiation therapy; treatment dosage administered;patient's condition noted and/or reported;treatment recorded;patient reassured,given explanation,instructions;materials, records placed for use;patient sent or escorted to next location.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt.'s radiotherapy treatment plan,requisition sheet, ID card,bracelet,medical-technical chart,prior radiographs,scans;view boxes;external beam treatment machine;controls,intercom;distance,beam angle indicators;table;light system;collimator;beam accessory holder;blocking tray;penis-holding box or jig with bolus;scales;x-ray film,holders;cassettes;cassette holder;immobilization devices;lead shielding;radiopaque ID markers;beam blocks or lead shielding;beam direction device,pin and arc,back pointer;side lights;beam block diagram plate;tape;scissors;dye, ink,sticks;pen,pencil;pt.instructions;stretcher, wheelchair;forms;soap,water

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Male radiotherapy patient;radiotherapist;co-worker family member;nurse

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Setting up a male radiotherapy pt.and administering external beam radiation therapy to the penis by reviewing treatment plan;preparing equipment and materials;reassuring,attending to pt.'s condition;noting,reporting danger signs to radiotherapist;positioning,immobilizing pt.for treatment;setting up direct,lateral parallel opposed,narrow anterior and posterior bilateral lymph node fields;positioning device to hold penis (and bolus if ordered);setting up beam blocks;making verification film;setting controls for prescribed dosage;administering radiation dosage;repeating for all fields;explaining self care, after-effects,danger signs to pt.;disassembling set-up;recording treatment;having pt.transported;placing records,materials for use.

List Elements

Performer sets up and administers external beam radiation therapy to a male patient scheduled to receive radiation treatment of the penis.

1. General initial steps include finding out what treatment is scheduled, the patient involved, the treatment plan, relevant history and circumstances, the attending radiotherapist and other staff involved, and specific information on the treatment for the day.
   a. Reviews background information on new or ongoing radiotherapy patient.
   b. Determines treatment set-up, patient's condition, purpose of treatment, the equipment ordered, special considerations, and checks that all information is complete.
   c. Checks whether treatment verification films will be required, whether dosimetry calculations have been reviewed, whether consent form has been signed, whether all clinical or lab information is present.
   d. Reviews details of set-up for the day, the fields to be treated, location, dimensions, accessories. Reviews treatment geometry, and prescribed dosage.

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 2 of 2 for this task.

Code 606

Performer's Name____________________ **Analyst(s)**____________________ **Dept.**________
Job Title____________________ **Institution**____________________ **Date**________

List Elements

2. If superficial or deep x-rays are to be used, this task is similar to Task Code 599; if megavoltage equipment, such as cobalt-60 teletherapy is to be used, this task is similar to Task Code 600. The task is similar to Task Codes 599 or 600 in the following general areas:

   a. Prepares materials and equipment ahead. Sets up accessories; checks that prior nursing services, safety check of equipment have been carried out. Checks for presence of all materials and equipment. If appropriate, sets controls for dosage for first field to be treated or for filming. Checks intercom and TV monitor.
   b. Greets and readies patient for set-up and treatment. Checks patient's condition and is supportive. Reports danger signs, missed appointments to radiotherapist. Explains to patient what will be done. Reinforces fading patient markings.
   c. Positions patient for first treatment field using triangulation marks.
   d. Adjusts beam angulation. May use beam direction equipment if necessary. Adjusts SSD with distance indicator or adjusts SAD using isocenter technique.
   e. Collimates to field using light system and patient markings. Applies beam blocking, tissue compensators, filtration, shielding as appropriate. Immobilizes patient.
   f. Makes treatment verification films if appropriate.
   g. Checks or sets radiation settings and controls. Administers radiation while observing patient and equipment. Responds to patient movement or emergency as appropriate.
   h. Continues with any other treatment fields.
   i. Disassembles treatment set-up.
   j. Explains self-care to patient, normal reactions to treatment, and danger signs to report.

List Elements

   k. Sees that patient is taken to appropriate next location.
   l. Records treatment as appropriate, including given and cumulative dose, skin or applied dose. May calculate.
   m. Returns custom-made accessories, records as appropriate.

3. Unique features of this task are as follows:

   a. Checks whether superficial x-ray, deep x-ray, or megavoltage equipment will be used and the machine.
   b. Performer notes area(s) to be treated, such as small superficial tumors, larger tumors of penile shaft or urethra, and/or lymph node areas of the groin, external iliac, hypogastric areas.
   c. Notes prescribed field layouts, such as single direct or parallel opposed lateral fields, and bilateral, narrow anterior and posterior lymph node fields with the midline blocked.
   d. Performer notes whether penis will be treated with bolus added (for use with megavoltage equipment).

      i) May position a special molded box to fit around the penis or jig to hold penis in upright position.
      ii) For megavoltage, positions the box or jig device with a bolus included.

   e. If deep x-ray therapy is to be used, protects scrotum and testes with lead shielding which rests on thighs and anterior abdominal wall.

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
This is page 1 of 2 for this task.

Code 607

Performer's Name________ Analyst(s)________ Dept.________
Job Title________ Institution________ Date________

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Patient set up for external beam radiation therapy; treatment dosage administered;patient's condition noted and/or reported;treatment recorded;patient reassured,given explanation,instructions;materials,records placed for use;patient sent or escorted to next location.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt.'s radiotherapy treatment plan,requisition sheet, ID bracelet,medical-technical chart,prior radiographs,scans;view boxes;external beam treatment machine,controls,intercom;distance,beam angle indicators;table;light system;collimator;beam accessory holder;blocking tray;scales,rulers;x-ray film,holders,cassettes;cassette holder;immobilization devices; shielding;sterile procedure tray;contrast medium; beam block diagram plate;radiopaque ID markers;beam blocks;beam direction device,pin and arc,back pointer;side lights;tape;scissors;dye,ink,sticks;pen,pencil;pt.instructions;stretcher,wheelchair;forms;soap water;bolus

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Any radiotherapy patient;radiotherapist;co-worker; family member;nurse

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Setting up any radiotherapy patient and administering external beam radiation therapy to the kidney and/or adrenal glands by reviewing treatment plan;preparing equipment and materials;reassuring,attending to pt.'s condition;noting,reporting danger signs to radiotherapist;positioning,immobilizing pt.for treatment;setting up anterior and posterior parallel opposed and lateral fields at treatment SSD;applying blocking to exclude remaining kidney from fields as ordered;making verification film;setting controls for prescribed dosage;administering radiation dosage;repeating for all fields;explaining self care,after-effects,danger signs to pt.;disassembling set-up;recording treatment; having pt.transported;placing records,materials for use.

List Elements

Performer sets up and administers external beam radiation therapy to any patient scheduled to receive radiation therapy of the kidney and/or adrenal glands (especially a pediatric patient with nephroblastoma or neuroblastoma or an adult with hypernephroma).

1. General initial steps include finding out what treatment is scheduled, the patient involved, the treatment plan, relevant history and circumstances, the attending radiotherapist and other staff involved, and specific information on the treatment for the day.
    a. Reviews background information on new or ongoing radiotherapy patient.
    b. Determines treatment set-up, patient's condition, purpose of treatment, the equipment ordered, special considerations, and checks that all information is complete.
    c. Checks whether treatment verification films will be required, whether dosimetry calculations have been reviewed, whether consent form has been signed, whether all clinical or lab information is present.
    d. Reviews details of set-up for the day, the fields to be treated, location, dimensions, accessories. Reviews treatment geometry and prescribed dosage.

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 2 of 2 for this task.

Code 607

Performer's Name__________ **Analyst(s)**__________ **Dept.**______
Job Title__________ **Institution**__________ **Date**______

List Elements

2. If deep x-ray equipment is to be used, portions of Task Code 599 are relevant as well as Code 600; if megavoltage equipment is to be used, Task Code 600 is relevant in the following general areas:

   a. Prepares materials and equipment ahead. Sets up accessories; checks that prior nursing services, safety check of equipment have been carried out. Checks for presence of all materials and equipment. If appropriate, sets controls for dosage for first field to be treated or for filming. Checks intercom and TV monitor.
   b. Greets and readies patient for set-up and treatment. Checks patient's condition and is supportive. Reports danger signs, missed appointments to radiotherapist. Explains to patient what will be done. Reinforces fading patient markings.
   c. Positions patient for first treatment field using triangulation marks.
   d. Adjusts beam angulation. May use beam direction equipment if necessary. Adjusts SSD with distance indicator or adjusts SAD using isocenter technique
   e. Collimates to field using light system and patient markings. Applies beam blocking, tissue compensators, filtration, shielding as appropriate. Immobilizes patient.
   f. Makes treatment verification films if appropriate.
   g. Checks or sets radiation settings and controls. Administers radiation while observing patient and equipment. Responds to patient movement or emergency as appropriate.
   h. Continues with any other treatment fields.
   i. Disassembles treatment set-up.
   j. Explains self-care to patient, normal reactions to treatment and danger signs to report.
   k. Sees that patient is taken to appropriate next location.

List Elements

   l. Records treatment as appropriate, including given and cumulative dose, skin or applied dose. May calculate.
   m. Returns custom-made accessories, records as appropriate.

3. Unique features of this task are as follows:

   a. Notes whether patient is to be treated immediately after surgery for prophylactic postoperative irradiation of the tumor bed, or is to receive pre-operative radiotherapy, or radiotherapy in conjunction with a non-surgical modality.
   b. Notes whether deep x-ray or megavoltage equipment will be used.
   c. Performer notes the areas to be treated and the field arrangements.

      i) Notes the side on which the tumor occurs.
      ii) Notes whether a pair of parallel opposed anterior and posterior fields is prescribed, including the kidney and/or renal bed, the paraortic glands, excluding the remaining kidney.
      iii) May note the use of a supplementary lateral field (such as with obese patient).
      iv) Notes whether the glands around the remaining renal blood vessels and renal pelvis are included in field.

   d. If treatment verification portal film is to be made, may assist with injection of iodine-based contrast, instruct patient of need to breathe shallowly and hold still during filming and/or treatment.
   e. Uses beam blocking for megavoltage; uses shielding for deep x-rays, if required, as ordered, to spare healthy tissues.

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
Code 608 This is page 1 of 3 for this task.

Performer's Name __________ Analyst(s) __________ Dept. __________
Job Title __________ Institution __________ Date __________

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Patient set up for external beam radiation therapy; treatment dosage administered;patient's condition noted and/or reported;treatment recorded;patient reassured,given explanation,instructions;materials,records placed for use;patient sent or escorted to next location.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt.'s radiotherapy treatment plan,requisition sheet, ID card,bracelet,medical-technical chart,prior radiographs,scans;view boxes;external beam treatment machine,controls;intercom;distance,beam angle indicators;table;light system;collimator;beam accessory holder;blocking tray;scales,rulers;x-ray film,holders,cassettes;cassette holder;immobilization devices; beam block diagram;radiopaque ID markers;beam blocks; beam direction device,pin and arc,back pointer;side lights;tape;scissors;dye,ink,sticks;pen,pencil;pt. instructions;stretcher,wheelchair;forms;soap,water; bolus;wedge filters

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Any radiotherapy patient;radiotherapist;co-worker; family member;nurse

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Setting up any radiotherapy pt.and administering external beam radiation therapy to the bone and/or soft tissue of an extremity by reviewing treatment plan; preparing equipment and materials;reassuring,attending to pt.'s condition;noting,reporting danger signs to radiotherapist;positioning,immobilizing pt.for treatment;setting up parallel opposed (frontal or lateral),single direct,multiple converging,or wedge fields using prescribed SSD or isocenter technique; making verification film;setting controls for prescribed dosage;administering radiation dosage;repeating for all fields;explaining self care,after-effects, danger signs to pt.;disassembling set-up;recording treatment;having pt.transported;placing records,materials for use.

List Elements

Performer sets up and administers external beam radiation therapy to any patient scheduled to receive external beam radiation therapy of the extremities in connection with tumors of bone and/or soft tissue.

1. General initial steps include finding out what treatment is scheduled, the patient involved, the treatment plan, relevant history and circumstances, the attending radiotherapist and other staff involved, and specific information on the treatment for the day.
   a. Reviews background information on new or ongoing radiotherapy patient.
   b. Determines treatment set-up, patient's condition, purpose of treatment, the equipment ordered, special considerations, and checks that all information is complete.
   c. Checks whether treatment verification films will be required, whether dosimetry calculations have been reviewed, whether consent form has been signed, whether all clinical or lab information is present.
   d. Reviews details of set-up for the day, the fields to be treated, location, dimensions, accessories. Reviews treatment geometry and prescribed dosage.

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 2 of 3 for this task.

Code 608

Performer's Name______________________ **Analyst(s)**______________________ **Dept.**__________
Job Title______________________ **Institution**______________________ **Date**__________

List Elements

2. This task is similar to Task Code 600 in the following general areas:

   a. Prepares materials and equipment ahead. Sets up accessories; checks that prior nursing services, safety check of equipment have been carried out. Checks for presence of all materials and equipment. If appropriate, sets controls for dosage for the first field to be treated or for filming. Checks intercom and TV monitor.
   b. Greets and readies patient for set-up and treatment. Checks patient's condition and is supportive. Reports danger signs, missed appointments to radiotherapist. Explains to patient what will be done. Reinforces fading patient markings.
   c. Positions patient for first treatment field using triangulation marks.
   d. Adjusts beam angulation. May use beam direction equipment if necessary. Adjusts SSD with distance indicator or adjusts SAD using isocenter technique.
   e. Collimates to field using light system and patient markings. Applies beam blocking, tissue compensators, filtration, shielding as appropriate. Immobilizes patient.
   f. Sets up and checks wedge filters as appropriate.
   g. Makes treatment verification films if appropriate.
   h. Checks or sets radiation settings and controls. Administers radiation while observing patient and equipment. Responds to patient movement or emergency as appropriate.
   i. Continues with any other treatment fields.
   j. Disassembles treatment set-up.
   k. Explains self-care to patient, normal reactions to treatment and danger signs to report.
   l. Sees that patient is taken to appropriate next location.

List Elements

   m. Records treatment as appropriate, including given and cumulative dose, skin or applied dose. May calculate.
   n. Returns custom-made accessories, records as appropriate.

3. Unique features of this task are as follows:

   a. Notes whether field arrangements include parallel opposed anterior and posterior or medial and lateral fields, a single appositional field, wedge pair fields (for soft tissue sarcoma). Notes whether entire length of an affected bone is to be included in field.
   b. For long fields notes whether two abutting fields are to be used with a moving field abutment, or whether the entire length is included in the treatment field by an increased SSD.

      i) For moving field abutment, notes the area to be treated for the given day.
      ii) Checks prescribed SSD and sets as appropriate.

   c. May apply a bolus prepared to achieve build-up over a surgical scar.
   d. For soft tissue sarcoma applies appropriate prescribed blocking to avoid including the full circumference of the extremity in the treatment volume.

      i) Depending on the location of the tumor, may protect part of patella, healthy skin and subcutaneous tissue in upper medial thigh, anterior tibial chin, soles, back of heel, Achilles tendon.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 3 of 3 for this task.

Code 608

Performer's Name________________ Analyst(s)________________ Dept.________
Job Title________________ Institution________________ Date________

List Elements Fully	List Elements Fully
ii) If a tissue compensating filter has been prepared or wedge filters prescribed, performer sets up and checks as appropriate.	

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
This is page 1 of 2 for this task.

Code 609

Performer's Name________________ Analyst(s)________________ Dept.________
Job Title________________ Institution________________ Date________

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Patient set up for external beam radiation therapy; treatment dosage administered;patient's condition noted and/or reported;treatment recorded;patient reassured,given explanation,instructions;materials,records placed for use;patient sent or escorted to next location.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt.'s radiotherapy treatment plan,requisition sheet, ID card,bracelet,medical-technical chart,prior radiographs,scans;view boxes;external beam treatment machine,controls;intercom;distance,beam angle indicators;table;light system;collimator;beam accessory holder;blocking tray;scales,rulers;x-ray film,holders,cassettes;immobilization devices;beam block diagram plate;whole body shell;radiopaque ID markers; beam blocks;beam direction device;side lights;tape; scissors;dye,ink,sticks;pen,pencil;pt.instructions; floor stretcher,wheelchair;forms,soap,water;bolus

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Any radiotherapy patient;radiotherapist;co-worker; family member;nurse

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Setting up any radiotherapy patient and administering external beam radiation therapy of the whole body by reviewing treatment plan;preparing equipment and materials;reassuring,attending to pt.'s condition;noting,reporting danger signs to radiotherapist;positioning,immobilizing pt.for treatment;setting up whole body,single direct field and SSD for required field length;blocking areas to be protected;making verification portal film;setting controls for prescribed dosage;administering radiation dosage;explaining self care,after-effects,danger signs to pt.; disassembling set-up;recording treatment;having pt. transported;placing records,materials for use.

List Elements

Performer sets up and administers external beam radiation therapy to any patient scheduled to receive external beam radiation therapy of the whole body (such as for chronic leukemia).

1. General initial steps include finding out what treatment is scheduled, the patient involved, the treatment plan, relevant history and circumstances, the attending radiotherapist and other staff involved, and specific information on the treatment for the day.
   a. Reviews background information on new or ongoing radiotherapy patient.
   b. Determines treatment set-up, patient's condition, purpose of treatment, the equipment ordered, and checks that all information is complete.
   c. Checks whether a treatment verification film will be required, whether dosimetry calculations have been reviewed, whether consent form has been signed, whether all clinical or lab information is present.
   d. Reviews details of set-up for the day, field dimensions, accessories. Reviews treatment geometry and prescribed dosage.
2. This task is similar to Task Code 600 in the following general areas:

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.

Code 609

This is page 2 of 2 for this task.

Performer's Name__________ **Analyst(s)**__________ **Dept.**__________

Job Title__________ **Institution**__________ **Date**__________

List Elements

a. Prepares materials and equipment ahead. Sets up accessories; checks that prior nursing services, safety check of equipment have been carried out. Checks presence of all materials and equipment. May preset dosage controls or controls for verification filming. Checks intercom and TV monitor.

b. Greets and readies patient for set-up and treatment. Checks patient's condition and is supportive. Reports danger signs, missed appointments to radiotherapist. Explains to patient what will be done. Reinforces fading patient markings.

c. Positions patient for treatment using triangulation marks.

d. Adjusts beam angulation. Adjusts SSD with distance indicator and light system.

e. Collimates to field using light system and patient markings. Applies beam blocking, tissue compensators as appropriate. Immobilizes patient.

f. Makes treatment verification film if appropriate.

g. Checks or sets radiation settings and controls. Administers radiation while observing patient and equipment. Responds to patient movement or emergency as appropriate.

h. Disassembles treatment set-up.

i. Explains self-care to patient, normal reactions to treatment and danger signs to report.

j. Sees that patient is taken to appropriate next location.

k. Records treatment as appropriate, including given and cumulative dose, skin or applied dose. May calculate.

l. Returns custom-made accessories, records as appropriate.

3. Unique features of this task are as follows:

a. Checks that appropriate clinical and lab tests such as blood studies have been carried out.

b. Performer may position patient in a curved "C" position as determined in simulation to reduce the size of the field.

i) May set up a single direct field.
ii) Follows the exact position of the patient in "C" position as recorded in treatment plan.
iii) May set up patient using a whole body shell, with patient lying on the floor, on stretcher. May apply a bolus if appropriate.

c. Sets the SSD at the predetermined height (that allows the entire patient-field to be covered by the collimated central ray) as shown by light system.

TASK CODE	EXTENDED TASK NAME
610	Reassuring any radiotherapy patient and/or accompanying family member about external beam radiotherapy procedures by using language appropriate to the level of comprehension involved; answering non-medical questions and referring to proper staff member for medical answers; explaining purpose of simulation, immobilization, localization, set-up, treatment procedures; explaining equipment; explaining what to expect, what radiation may feel like, need for patient to be alone during treatment but under observation, that patient will not be radioactive; treating patient with dignity, compassion; providing honest answers, emotional support; reinforcing positive self-image; attempting to calm patient.
611	Explaining to any out-patient or accompanying family member proper at-home procedures to follow prior to coming for radiation therapy treatment, by reading what is required; presenting written instruction; explaining; and checking that patient or family member understands.
612	Preparing external beam treatment equipment with appropriate attachments (such as attaching or removing electron beam collimator and beta ionization chamber, attaching beam block tray, preparing periscope cone), by reviewing what is required, modality and machine involved; obtaining attachments; positioning equipment for changeover; removing or attaching accessories; repositioning equipment; reporting when done if appropriate.
613	Calculating and recording, or checking and reporting errors in calculations, in external beam radiation treatment plan or in therapy chart, such as effective area, dose time or monitor units, central axis depth dose, prescribed total tumor dose versus total given dose, according to predetermined formulae, using appropriate information, by obtaining or receiving materials and calculations to be done or checked, appropriate charts, formulae, needed information; reviewing how to calculate or check; considering field sizes, areas to be blocked, effective area, tumor dose, given dose, number of treatments, SSD or SAD, backscatter factor, applied dose factor as appropriate; making appropriate calculations; entering on form, or comparing with figure already entered; reporting discrepancy as appropriate and/or placing for filing; recording check.
614	Adding and recording accumulated given doses and/or weekly and final tumor doses, or checking and reporting calculation errors, in radiotherapy treatment charts, by obtaining treatment charts; adding daily applied doses, daily tumor doses as appropriate; entering or comparing with figures entered; reporting discrepancies and/or placing for filing; recording check.

TASK CODE	EXTENDED TASK NAME
615	Planning and arranging procedures for intracavitary or interstitial radiation therapy (brachytherapy) by reviewing proposed treatment plan, nature and location of tumor, patient's condition, noting method of treatment, arrangement of source, personnel involved, procedures and radiographic checks required; determining appropriate sequence of events; arranging to schedule such procedures as localization filming for dosimetric calculations, manufacture of or order for applicators, orders for photography, for source to be applied, implantation, instillation, or insertion of applicator(s), check films of applicators or implants, remote afterloading of radioactive source, removal of temporary implant, nursing care, as appropriate.
616	Reassuring any radiotherapy patient and/or accompanying family member about intracavitary,or interstitial implant,or instillation,or remote afterloader procedures by using language appropriate to the level of comprehension involved; answering nonmedical questions and referring to proper staff member for medical answers; explaining purpose of implantation, insertion of applicator, instillation, localization and treatment procedures; explaining equipment; explaining what to expect, what radiation may feel like, need for patient to be alone during remote afterloader treatment but under observation; explaining radiation safety precautions; treating patient with dignity, compassion; providing honest answers, emotional support; reinforcing positive self-image; attempting to calm patient.
617	Calculating treatment time for remote afterloader intracavitary radiation treatment or checking calculation by obtaining or receiving information on applicator diameter and selected oscillation or length and determining rate from prepared table; dividing prescribed dose as appropriate to obtain rate for the given treatment; dividing rate by the present activity of the sources to obtain time; recording or checking and reporting error.
618	Reinforcing or informing internal radiation therapy patient about expected reactions to therapy, self care, and danger signs to report, by reviewing patient's condition, treatment plan, stage of treatment,and physician's or institution's recommendations; discussing side effects, danger signs to note and report, procedures for self care; answering questions; providing check list if available.

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
Code 619 This is page 1 of 4 for this task.

Performer's Name____________ Analyst(s)____________ Dept.________
Job Title____________ Institution____________ Date________

1. **What is the output of this task?** (Be sure this is broad enough to be repeatable.)

Localization films made of patient for dosimetry or check of implant or applicator position; films approved, placed for use.

2. **What is used in performing this task?** (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt.'s x-ray requisition form,ID card,bracelet,treatment plan,chart;diagnostic x-ray unit,tube(s),controls,collimator;graduated radiopaque markers,tubes, radiopaque R or L marker;procedure tray with radiopaque solutions;dummy sources;immobilization devices; x-ray table;loaded cassettes;cassette holder;shielding;soap,water;tape;scissors;calipers;technique chart;view boxes;operating room garments

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Radiation therapy patient;nurse;co-worker;radiotherapist;physicist;anesthesiologist

5. **Name the task** so that the answers to questions 1-4 are reflected. Underline essential words.

Taking localization films of intracavitary applicator or interstitial implant prior to treatment of a radiation therapy patient by reviewing request; preparing materials and equipment; selecting and setting technical factors; explaining, reassuring patient; positioning patient; placing markers for later calculations; shielding; making AP and lateral, stereo or single exposures with and without contrast and special markers; arranging for processing and review of films by radiotherapist or physicist; repeating as ordered; recording; placing for use.

List Elements

Performer makes pre-treatment localization films (radiographs) of any radiotherapy patient who has had an intracavitary applicator inserted,or an interstitial implant surgically introduced, prior to treatment with a radioactive isotope source,as ordered.

1. General initial steps include finding out the patient involved, the area to be radiographed, the views and type of films ordered, patient's condition, where localization films will be made (if more than one location is possible), whether the films are check films of applicator or implant position and/or will be used for dosimetry calculations, what radiopaque contrast will have to be instilled, the radiotherapist and/or physicist in charge to approve radiographs, and whether performer will be processing films personally.

   a. Depending on institutional arrangements, performer may receive or obtain the x-ray requisition form, patient identification card, the proposed or approved treatment plan,may note assignment on schedule sheet, or receive request to perform localization radiography.

   b. Performer may be assigned to diagnostic unit in radiotherapy department where patient is brought, or may report as appropriate to

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 2 of 4 for this task.

Code 619

Performer's Name____________________ Analyst(s)____________________ Dept.__________
Job Title____________________ Institution____________________ Date__________

List Elements

designated treatment or operating room equipped with a diagnostic x-ray unit.

c. Performer notes what is called for, such as localization of post-operative implants, of applicators, whether AP and lateral conventional films at right angles are required, or stereographic films in AP and lateral projections, and any special views ordered.

   i) Notes what accessories will be used for dosimetric purposes, such as placement of calibrated scales or indicators for calculation of magnification factor and distances.
   ii) Notes target-to-film distance (TFD) prescribed.
   iii) Notes the patient's name, identification number, sex, weight and age. Notes the name of the radiotherapist in charge.
   iv) Notes whether patient is in-patient, out-patient.
   v) Checks whether patient is suffering from a collateral condition requiring special attention in handling, such as heart disease, communicable or infectious condition, infirmity, incoherence, behavioral disorder.
   vi) Checks whether applicator, balloon catheter, IV drip, or oxygen mask will have been inserted or attached to patient and must be handled so as not to become dislodged during procedure.

2. At appropriate time, performer reports to appropriate location and prepares ahead so as not to keep patient in room longer than necessary.

   a. If reporting to operating room, performer dons proper dress for operating room and observes appropriate

List Elements

sterile technique. Reports to appropriate physician in charge or anesthesiologist.

   b. Performer may check that dummy sources are present in room. Makes sure all procedure trays and accessories are present.
   c. Checks technique chart to review technical exposure factors. Prepares radiopaque identification markers if appropriate, right and left markers. Checks that an adequate supply of cassettes, loaded with correct type of film of appropriate sizes and with correct grid or screen combinations are available, or decides to prepare personally.
   d. Checks that equipment is "warmed up" and ready for use. May preset technical factors, TFD. May set up vertical cassette holder for lateral filming.
   e. Washes hands as appropriate.
   f. If appropriate, checks that patient is accompanied by staff member, has had vital signs taken and recorded, and/or that an appropriate elapse of time has occurred after prior procedures, such as removal of drainage tubes.

3. If not already done, has patient brought to room and placed on radiographic table or decides to do personally.

   a. Greets patient. Checks identification. Checks that patient is properly prepared.
   b. Explains to patient what will be done. Transfers and positions patient on diagnostic table or has this done, being careful not to dislodge IV, applicator, Foley catheter or rectal tube. Places patient in supine position and centers on table.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 3 of 4 for this task.

Code 619

Performer's Name ____________ Analyst(s) ____________ Dept. ________
Job Title ____________ Institution ____________ Date ________

List Elements

c. Checks patient's condition and is supportive. Reports any danger signs to radiotherapist.
d. If appropriate, tapes catheter into position under tension to hold in place.
e. Unless measurements have already been made, uses centimeter calipers to measure the thickness of the patient in the directions in which the central ray of the x-ray beam will pass through the centered part from tube to film for AP and lateral films.

    i) Determines technical factors from technique chart.
    ii) Sets kVp, mA and time, or as appropriate for automatic exposure control.

f. Places cassette in bucky, cassette tunnel or slot; centers to the area of interest for AP projection.
g. Uses light system and centers overhead x-ray tube to center of area of interest as shown by crosshairs.
h. Places R or L marker and any other marker for calculation of magnification factor so that it can be included in image but will not obscure applicator or implant image. Places similar marker on patient's side next to vertical cassette holder at same level as marker for AP projection.
i. Collimates to area of interest and includes markers.
j. May immobilize patient. Provides gonadal shielding if appropriate.
k. Inserts dummy sources all the way into applicator if appropriate.
l. Checks that FFD is correct, and that central ray is at right angles to film.
m. For intrauterine dosimetric study, inserts tube with graduated lead markers into rectal tube. May apply other calibrated marker as appropriate.

List Elements

n. Instructs patient to hold still when so requested.

4. Performer clears area and makes AP exposure(s) from behind barrier or in control booth:

    a. From control booth, checks patient position, technical factors. Has patient hold still, and makes AP exposure.
    b. If stereo exposures are required, replaces cassette with another of same size; moves tube or table appropriate distance and direction and records shift. Makes second AP exposure as described.
    c. For prostate dosimetric study, inserts a graduated lead marker tube with stop marker into outer rectal tube; takes a second set of AP stereo films.

5. Performer makes lateral exposure(s), maintaining patient in same position:

    a. Sets TFD to same distance as AP films, with lateral x-ray tube directed across table in horizontal direction (at right angles to AP position and to film in vertical holder).
    b. Centers and collimates as appropriate.
    c. Resets technical factors if appropriate
    d. Makes lateral exposure.

        i) If appropriate, makes second stereo lateral exposure and records direction of shift as described.
        ii) For intrauterine study, removes the graduated rectal marker. Has nurse or MD instill barium mixture in rectum. Makes another lateral exposure.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 4 of 4 for this task.

Code 619

Performer's Name ____________ Analyst(s) ____________ Dept. ________
Job Title ____________ Institution ____________ Date ________

List Elements

iii) For prostate study, has nurse or other staff member instill radiopaque contrast into Foley catheter balloon. Makes lateral exposure with radiopaque solution and graduated rectal tube in place.

6. Performer has radiographs processed at once or decides to do personally.

   a. May measure and record the TFD for each film, and the focal spot-to-tumor distance. Utilizes the distance from the lead marker to the image of implant or applicator on each AP film and the known TFD to determine focal spot-to-tumor distance.
   b. Displays processed radiographs on view boxes, and calls radiotherapist or physicist, or brings for approval.
   c. Makes sure patient is being attended.
   d. If physicist or radiotherapist decides that films are not adequate for dosimetry purposes, adjusts and repeats as appropriate, as directed.

7. When all exposures have been made and approved, has rectal and urinary catheters emptied and removed, or decides to do personally.

   a. May have patient's vital signs taken and recorded.
   b. Removes lead markers from patient's body and any dummy sources.
   c. Helps patient return to stretcher or wheelchair if appropriate, or has this done.
   d. Makes sure that patient is properly accompanied to next scheduled location or back to room.
   e. Arranges for appropriate clean-up procedures.
   f. Records radiography. Makes sure radiographs are properly identified. Signs requisition.

List Elements

   g. May arrange to jacket films, requisition sheets, and related materials, and/or has information recorded in log book, depending on institutional procedures, or places for use or filing as appropriate.

TASK CODE	EXTENDED TASK NAME
620	Assisting radiotherapist in application and/or removal of intracavitary applicator for remote or conventional afterloader radiation treatment of any patient, by reviewing treatment plan; checking for consent; preparing materials; greeting patient; checking identification; reassuring, preparing and positioning patient with drape and garments to be used to secure applicator; preparing and/or obtaining applicator and ovoid of correct size, ahead or when prescribed, using antiseptic technique; recording size; assisting with insertion of intracavitary applicator, rectal or other tube for dose monitoring; securing in position as requested; escorting patient to treatment location; returning patient after treatment; removing or assisting in removal of applicator; arranging to have cavity irrigated if appropriate; disposing of or cleaning materials using antiseptic technique; explaining self-care, aftereffects, danger signs to patient; having patient scheduled, transported; placing materials, records for use.
621	Transporting sealed radioactive isotopes within institution from storage to treatment area safes following appropriate safety precautions by reviewing request and procedures; obtaining and preparing safe transport vehicle; transferring sources following safety procedures; transporting; transferring to treatment area safe following safety procedures; responding as appropriate to accident or spills; recording as appropriate.

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
This is page 1 of 7 for this task.

Code 622

Performer's Name ______ Analyst(s) ______ Dept. ______
Job Title ______ Institution ______ Date ______

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Patient reassured, explained procedure, set up for intracavitary treatment with afterloader; localization radiographs made and approved; afterloader source tubes attached to applicator tubes; controls set; treatment given with afterloader; patient follow-up, instructions, removal of applicator arranged; treatment recorded; materials, records placed for use.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Pt.'s radiotherapy requisition,treatment plan,chart, ID bracelet;remote afterloader source tubes,dose monitoring tube,adaptors in treatment room;afterloader control panel,intercom,TV monitor;diagnostic x-ray unit and controls;treatment table or chair;dummy sources;view boxes;calipers;tape;scissors;loaded cassettes,ID and R or L markers;cassette holder;immobilization devices;shielding;pen,pencil;soap,water;stretcher

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Any intracavitary radiation therapy pt.;radiotherapist;co-worker;nurse

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Taking localization radiographs and administering intracavitary radiation therapy with remote afterloader to any internal radiation therapy patient by reviewing treatment plan;preparing materials;checking equipment;reassuring,explaining to,positioning pt. after insertion of intracavitary applicator;making localization films for review;attaching applicator to source tubes;setting controls;administering treatment from control room while monitoring;terminating; arranging for after care,explanation,removal of applicator,irrigation,transport of pt.;recording treatment;placing records,materials for use.

List Elements

Performer radiographically checks position of applicator and administers intracavitary radiation therapy using a remote afterloader to any radiation therapy patient scheduled for intracavitary treatment,such as uterus, cervix, vagina, nasopharynx, or other body cavity.

1. Depending on institutional arrangements, performer may have prepared patient and assisted with applicator insertion procedures.

   a. Performer may receive or obtain the patient's requisition sheet, approved treatment plan, chart, and any other relevant technical or clinical information as a result of regular assignment, checking schedule sheet, having arranged requisitions in order of priority,or from co-worker.
   b. Patient may be brought to treatment room by co-worker or performer immediately after insertion of applicator in examination room,or performer may be responsible for bringing patient to treatment room from holding area after applicator has been inserted.
   c. See Task Code 620 for preparatory steps and steps related to insertion and removal of applicator. See Task Code 617 for calculation or determination of treatment time.

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 2 of 7 for this task.

Code 622

Performer's Name________________ Analyst(s)________________ Dept.________
Job Title________________ Institution________________ Date________

List Elements

2. Performer reviews background information on a patient in current treatment, or reads information on a new patient to become familiar with the case.

   a. Determines what type of treatment arrangement is called for, the patient involved, patient's condition, the cavitary area to be treated, any special considerations, and checks the completeness of information provided.
   b. Notes the patient's name, identification number, sex, age, size, the radiotherapist in charge, and any other staff assigned. Notes whether patient is new or is in the course of treatment.
   c. Notes the body cavity to be radiographed and treated.
   d. Notes treatment plan:

      i) Depending on area to be treated, notes number of source tubes to be connected to applicator.
      ii) Notes whether a tube will have been inserted in an adjoining cavity (such as rectum when applicator is in uterus and vagina), and whether performer will be required to connect rectal tube to a tube leading from a dose rate monitor.
      iii) Checks the prescribed dosage and number of treatments to be applied.
      iv) For a patient in ongoing therapy, checks the approved treatment time, the type and size of applicator (and ovoid) prescribed. May check that record of prior treatments and MD's notes have been entered in patient's chart.
      v) If patient is present for first treatment, performer determines the standard or special size of applicator to be inserted from radiotherapist in charge or notes on record sheet. Records. Has treatment time for the given treatment calculated or checked and recorded, based on the applicator diameter and selected oscillation (or length) (and ovoid if appropriate), or decides to do personally. Arranges to have radiotherapist review and approve before administering treatment.

   e. Reviews patient's condition:

      i) Checks whether patient is suffering from a collateral condition requiring special attention in handling, such as heart disease, communicable or infectious condition, infirmity, incoherence, behavioral disorder.
      ii) Checks whether catheters, rectal tube, IV drip, or oxygen mask will have been inserted or attached to patient and must be handled so as not to become dislodged during procedure.
      iii) Considers whether the patient's psychological state must be considered to ensure proper attention to the patient.

   f. Notes localization radiographs ordered, such as projections, focal spot-to-film distance (FFD), any shielding to be provided to the gonads or to a fetus. Notes whether performer will process films personally
   g. If performer has any questions about the treatment plan, discusses with appropriate staff person such as radiotherapist. Proceeds after obtaining needed information, signature, or orders.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 3 of 7 for this task.

Code 622

Performer's Name________________ Analyst(s)________________ Dept.________
Job Title________________ Institution________________ Date________

List Elements

3. When performer is clear about what will be involved in the treatment, he or she prepares ahead so as not to keep the patient in the treatment room longer than necessary:

   a. Checks that safety warning lights are operative above treatment room and control room doors, and that no unauthorized persons are in control room. Clears treatment room.
   b. May check that intercom is operative. Checks that audio and video monitors are turned on and operating correctly.
   c. If not already done, checks treatment equipment by setting up for mini-treatment. Closes treatment (loading room) door and observes movement of sources by way of TV monitor from control room position.

      i) Checks that sources emerge, advance, and return to safe as appropriate.
      ii) Observes that rate meter functions properly in relation to the position of the sources.
      iii) Notes that lights and audio signal reflect position of the sources.
      iv) Observes trailing end of cables in tubing and measures distances at control panel. Notes during cycling whether travel distances are accurate as set.
      v) When sources return to lead safe, checks that all switches are at "off" position, cables in correct position and ends even, monitor meter at zero, and audio signal functioning appropriately.

   d. Reports any equipment breakdown immediately as appropriate.

List Elements

   e. Checks that x-ray equipment is "warmed-up" and ready for use. If performer finds any of the controls inoperative, notifies appropriate staff member. Proceeds as ordered.
   f. Performer positions treatment table or chair, depending on the area to be treated, in front of the lead safe holding the radioactive sources.
   g. Checks that plastic tubes reach from safe to where patient will sit or lie. May readjust TV monitor camera so that appropriate areas will be visualized; may adjust brightness, focus.
   h. Performer may check that dummy sources are present in room. Makes sure all materials needed are present.
   i. Checks technique chart to review x-ray technical exposure factors.

      i) Checks that an adequate supply of cassettes, loaded with correct type of film of appropriate sizes, and with correct grid or screen combinations are available, or decides to prepare personally.
      ii) May set up cassette in vertical holder for lateral filming.
      iii) Prepares identification marker. Obtains loaded cassette or film holder of type appropriate for the equipment, and size appropriate for the applicator to be localized.
      iv) Attaches identification information as appropriate and places in position, such as under the anticipated location of the applicator when patient is positioned.
      v) May preset technical x-ray factors and FFD.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
Code 622
This is page 4 of 7 for this task.

Performer's Name________________ Analyst(s)________________ Dept.__________

List Elements

4. Performer receives the patient and prepares for the localization and treatment:

   a. Performer washes hands as appropriate. Depending on patient's condition and the materials involved, follows appropriate antiseptic and aseptic techniques.
   b. May have the patient brought from the holding area or examination room (if not already done), or decides to do personally. Depending on institutional arrangements, performer may decide to assist.
   c. Performer greets patient and any accompanying staff person and introduces self. Checks patient's identity against the requisition sheet. With in-patient, checks hospital identification bracelet or other identifier. Checks with any accompanying staff member on any special precautions necessary during procedure.
   d. Performer makes patient comfortable on the treatment table or chair. Is careful not to dislodge tubes, catheters,and any life support devices, as well as applicator just inserted.
   e. Performer carefully explains procedure to patient, and what to expect. Uses language appropriate to patient's level of comprehension.

      i) Explains to patient what steps will be carried out, what positions patient will be in, what immobilization devices will be used, what cooperation will be asked of patient.
      ii) Notes that radiation therapy patients may be concerned or frightened about the procedures involved. May explain the radiotherapy process. Explains that the radiation for filming and/or treatment produces no sensation.

List Elements

      iii) Explains why patient will be in separate room for treatment, how patient remains under observation, and shows how patient can communicate with performer during filming and treatment. May practice using inter-communication system.
      iv) Explains equipment in layman's terms. Explains how patient can help by remaining perfectly still during the filming and treatment.
      v) Performer exercises care in reassuring patient while treating patient with dignity and compassion, bearing in mind that patient is suffering from a malignant disease that may be terminal, or with uncertain or poor prognosis. Without being blandly optimistic, performer tries to put patient at ease.
      vi) Considers the patient's psychological state, noting that the diagnosis may have been recent. Notes that patient may be frightened, emotionally disturbed, subject to behavioral disorders, may be incoherent, depressed, withdrawn, bitter,or hostile. Performer attempts to exercise consideration, respect, understanding, and as much warmth as possible. Treats patient with dignity and concern regardless of patient's behavior.
      vii) Performer is careful to be supportive of the patient with respect to the patient's self-concept, body image and acceptance of the situation that there is a disease condition to be treated or palliated.
      viii) If performer notes any unusual behavior or physical indication, or if patient is in an unusually

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
Code 622 This is page 5 of 7 for this task.

Performer's Name________	Analyst(s)________	Dept.________
Job Title________	Institution________	Date________

List Elements

agitated state or in great pain, performer may notify radiotherapist without alarming patient.

ix) Except with patient with applicator inserted through or in mouth (and unable to speak), performer answers patient's non-medical questions honestly; attempts to reassure patient and develop confidence. If questioned about medical prognosis, performer refers patient to his or her attending radiotherapist and indicates that refusal is result of ethical considerations rather than unwillingness to deal with patient. Performer does not lie or invent information.

5. Performer positions patient for localization filming as for treatment.

   a. If appropriate, inserts dummy sources in applicator or requests co-worker or physician to do. For nasopharynx, checks that patient bites down lightly on mouthpiece.
   b. If appropriate, performer may measure the patient in order to select exposure factors. May use centimeter calipers to measure the thickness of the area to be radiographed in the direction(s) in which the central ray of the x-ray beam will pass through the centered part from tube to film. Records for use in determining exposure factors.
   c. Selects the exposure factors for the first projection by consulting the technique chart posted for the machine to be used. Sets technical factors (kVp, mA, time) or as appropriate for automatic exposure timing.
   d. Places cassette in bucky, cassette tunnel or slot; centers to the area of interest for AP or lateral projection. Uses light system and centers overhead or lateral x-ray tube to center of area of interest as shown by crosshairs, at right angles to film. Adjusts TV monitor so that patient is visible at control panel.
   e. Collimates to include area of interest. Makes sure that right or left marker and other identification information will be recorded on film.
   f. May immobilize patient. Provides gonadal shielding if appropriate.
   g. Checks that FFD is correct, and that central ray is at right angles to film.
   h. When everything is ready for the exposure, performer explains what will happen and the importance of holding still during exposure.
   i. Makes sure everyone leaves the room. Explains to patient that performer and other staff are nearby in control room and that patient is under observation.
   j. Performer returns to control room to make exposure.

      i) Makes sure controls are properly set and patient is still in position.
      ii) Tells patient when to hold still by using intercom.
      iii) Initiates exposure by using the appropriate exposure control.
      iv) Makes sure exposure is terminated as appropriate.
      v) After exposure is completed, tells patient that he or she can relax.

   k. If appropriate, removes cassette and sets up x-ray tube and cassette for right angle film (lateral if AP film has just been exposed).

      i) Maintains patient in same position.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 6 of 7 for this task.

Code 622

Performer's Name________________ Analyst(s)________________ Dept.________
Job Title Institution________________ Date________

List Elements Fully

- ii) Sets FFD to same distance as AP film, with lateral x-ray tube directed horizontally.
- iii) Centers and collimates as appropriate.
- iv) Resets technical factors if appropriate.
- v) Makes lateral exposure.

l. Performer has radiographs processed at once or decides to do personally.

m. Displays processed radiographs on view boxes and calls radiotherapist, or brings for approval.

- i) Makes sure patient is being attended.
- ii) May wait while radiotherapist repositions applicator.

n. When localization films have been approved, removes any lead marker from patient's body and any dummy sources.

6. Performer connects tube(s) connected to source(s) and dose monitor:

a. Connects one, two or three tubes from applicator to corresponding plastic or nylon tubes leading to sources, depending on area to be treated. May connect tube from other body cavity to dose monitor tube.

- i) Uses special adaptors.
- ii) May push each nylon or plastic tube all the way into metal tubes up to stopper.
- iii) May tape tubes into position.

b. At control panel checks audiovisual monitors; makes sure patient's face and applicator are visible.

c. When ready to carry out treatment, reminds patient how to communicate, and reviews need for patient to remain still. Clears treatment room and closes door.

List Elements

7. In loading and applying treatment performer stands at control panel. Observes patient, applicator and movement of sources throughout procedure.

a. Turns on main switch with key.

b. Checks that loading room is empty, patient is in position, and door is closed. Checks that cable lock switches are off, and sets cable advance switch as appropriate.

c. Adjusts scale length to length of applicator. Sets cycle switches as appropriate to adjust scales to lowest point.

d. Sets timer as prescribed.

e. Pushes buttons to bring down wires or pushes manually.

f. Checks markers to show advancement of cable.

g. Activates cable lock switches, timer switch and cycle switches.

8. During treatment, observes patient on TV monitor and is alert for any signs of distress or sounds from patient over intercom.

a. May reassure patient during procedure using intercom. May periodically indicate the time remaining.

b. Observes the position of the sources, the rate meter, signal lights and cables. Checks that advancement and cycling are operating appropriately.

c. If any emergency arises, performer operates controls to withdraw sources into safe, and calls appropriate staff. Records the treatment already administered. May use emergency controls.

d. After treatment is completed, performer sets timer switch, cycle switches to off positions.

- 1) Moves cables to lower limit. Checks that monitor meter is at zero, audio signal is random.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page _7_ of _7_ for this task.

Code 622

Performer's Name__________ Analyst(s)__________ Dept.__________
Job Title__________ Institution__________ Date__________

List Elements

ii) Uses key to turn off main switch.
iii) Checks that cables are even.

e. When sources are in safe position performer enters treatment room.

i) Disconnects tube(s) from applicator and monitoring catheter. Attaches to wall holders. Removes any other immobilization devices.
ii) Calls radiotherapist or staff member to remove applicator and irrigate cavity as appropriate, or decides to do personally (Task Code 620).

f. If appropriate, performer may decide to reinforce or inform patient about expected reactions to therapy, self-care, and danger signs to report, or arranges to have this done (Task Code 618).
g. Performer notes next location for which patient is scheduled, such as examination or recovery area to have applicator removed, scheduling for next treatment, back to room or for return home.
h. If appropriate, makes sure that patient is in the care of a staff person who will transport to appropriate next location or, if out-patient, will arrange to discharge or send patient home (with family member or escort if appropriate).
i. May have room and equipment cleaned; has any other appropriate clean up procedures followed to avoid infection or contamination, or decides to do personally, depending on institutional procedures.
j. Performer records the treatment delivered according to institutional procedures.

i) Records date, time if appropriate, the number of the treatment, and the number of days since the last treatment, as appropriate.
ii) Records the given dose and the cumulative dose. May have radiotherapist review and sign treatment chart.
iii) Records any appropriate related information such as localization films taken, whether treatment was interrupted, any problems encountered, what was done or decided. Records any unusual behavior or symptoms of patient.
iv) Signs chart as appropriate.

k. May arrange to jacket films, requisition sheets, and related materials and/or have information recorded in log book, depending on institutional procedures.
l. May indicate to appropriate staff person when the performer is ready to proceed with next treatment.

CHAPTER 4

ABOUT THE TASKS IN DIAGNOSTIC ULTRASOUND TECHNOLOGY

INTRODUCTION

HSMS work in diagnostic ultrasound technology is an application of the abbreviated form of the HSMS method to a newly emerging occupational area. Chapters 4 and 5 deal with the technologist function in medical diagnostic ultrasound. The coverage is not as exhaustive as is the case with HSMS work in radiologic technology. We present only major examinations and the more common applications of ultrasound technology.

The clinical use of ultrasound for medical diagnosis is relatively new and still emerging when viewed in terms of acceptance, standardized use, and codification in texts. The state of and standards for equipment are still undergoing great and rapid change; the diagnostic significance of the technique is still debated, and the applications of and weight given the results vary widely. However, there is no doubt that the technique will eventually be an accepted part of the diagnostic arsenal in health care.

The work at the technologist level is emerging and far from standardized. Not only are the tasks assigned to the technologist in this field widely varied in content and level of responsibility, but there are already jurisdictional disputes about the personnel who should carry out the work. Should the new training, which clearly must be given, be open only to those who are already radiologic technologists and/

or registered nurses? Should this be a separate allied health specialty with a curriculum once again indifferent to prior training? Should relevant training already obtained be credited and used for advanced standing in a specialized curriculum? What would be the content of a specialized curriculum? What is relevant in other curricula?

It appears to this observer that there is a serious question about the relevance or need for fully accredited training in co-lateral occupations such as radiologic technology or nursing before an individual is allowed to carry out diagnostic ultrasound tasks. To require that an individual newly seeking occupational preparation and employment be forced to take courses that will not be used is a waste. On the other hand, some skills and knowledge areas may need to be studied more intensively for ultrasound; there are some new subjects, as well, that are not covered in the programs for radiologic technologists or nurses.

None of this means that radiologic technologists and/or nurses should not be considered for ultrasound training. It is a matter of determining what overlap exists across the respective areas of required skills and knowledges and what new skills and knowledges or higher levels of skills and knowledges need to be taught. Then it can be determined for which groups the ultrasound work is a step up a job ladder, and for which other groups it is a lateral step.

Obviously, the prior question is, what does the ultrasound technologist have to know how to do? In Chapter 5, HSMS offers a set of task descriptions, summaries, and extended task names that we suggest are a representative set of activities for the diagnostic ultrasound technologist. They are offered with the hope that the task breakdowns and descriptions will help provide an objective base to be used in the sorting out of occupational responsibilities, curriculum requirements, and professional jurisdiction. Research Report No. 10, which presents the skills and knowledges needed to perform the tasks, examines the overlap among the fields of radiologic technology, radiation therapy technology and diagnostic ultrasound technology, including some related patient care activities.

COVERAGE

The task descriptions, task summaries, extended task names, and abbreviated task names included in this report cover a representative set of ultrasound modalities and specialties, but not all applications in diagnostic ultrasound.

We include examinations which have been acknowledged in the literature as widely accepted. However, we have omitted the work in ophthalmology and in the use of endoscanners due to our time limitations. Ultrasound is being used to assist physicians to perform aspirations such as amniocentesis, renal cyst punctures, and biopsies such as those of the liver or pancreas. These are not specifically described, but we do include tasks covering the modalities and areas of the body involved.

The task descriptions are differentiated by modality (A-mode, B-mode scan, M-mode, and Doppler motion detectors), and by the body area involved. This reflects the way the work is assigned and reflects differences in skill and knowledge requirements.

The task describing A-mode echoencephalography is to be regarded only as a statement of basic procedures. While the equipment and the approach to the detection of intracranial interfaces has remained somewhat stable, some institutions have greatly increased their capabilities, and a large number of intracerebral structures are now detectable and recognizable. As of early 1977, for example, A-mode echoencephalography is being utilized at King's County Hospital in Brooklyn, New York, for measurement of the size of the lateral ventricles, detection of diffuse or local atrophic lesions of the cerebral hemispheres, detection of congenital abnormalities of the brain in neonates and children, acoustic characterization of neoplasms, early detection and follow-up of central nervous system infectious processes, detection of displacement of the aqueduct of Sylvaus due to posterior fossa lesion, and other similar uses.

Unfortunately, such utilization of A-mode is reliable only in the hands of highly trained and experienced sonographers. It is therefore "operator dependent." As a result, with the advent of computerized transverse axial tomography (described in Research Report No. 7), the use of echoencephalography as a diagnostic tool has steadily declined and is not likely to be widely used for brain work.[1] We therefore chose not to spend the time to develop task descriptions for the more advanced A-mode techniques of echoencephalography.

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[1] I appreciate the help of Larry D. Waldroup, Chief Technologist in Neuro-ultrasound at Kings County Hospital, and clinical instructor at the College of Health Related Professions, State University of New York at the Downstate Medical Center of Brooklyn, who provided much of this information and helped the author understand some of the issues involved.

We include some tasks that cover patient care functions, equipment-related activities, equipment tests, several administrative activities, and some housekeeping. These were not covered exhaustively due to our lack of time. For the same reason we do not include teaching tasks and other tasks that normally round out the technologist function. Models for some of these areas appear in Research Report No. 7 in connection with diagnostic radiology. Some tasks of Research Report No. 7 overlap with ultrasound technology, and these are acknowledged.

The task descriptions and summaries are uneven in the level of detail presented. Since the clinical equipment used in the field is varied and undergoing rapid change, we attempted to write broadly-based descriptions. We reflect the emergence of gray-scale displays, the less common water-coupled machines, and assume the existence of units with combined modalities for A-mode, B-scan, and M-mode. Our intent is to have descriptions remain viable as the equipment changes.

COLLECTION

The work of collecting the task identifications and descriptions was carried out at the Downstate Medical Center of the State University of New York in Brooklyn, and at St. Lukes Medical Center in New York. The task descriptions developed by HSMS analysts in the field were supplemented by existing literature, informal discussions with people in the field, and review by the experts acknowledged at the beginning of this report.

The field work began in 1973. A single team of HSMS analysts was assigned. However, the work was soon suspended so that our work in diagnostic radiology could be completed first. As a result, the tasks presented here were completed in 1976-77.

The initial task material covering A-mode, B-scan and Doppler detectors was obtained by interview and observation of performers. The M-mode descriptions are based on the literature. The task descriptions include generic and optimal procedures not always found in practice in the field. The "desiderata" were gleaned from recent texts and articles written for the physician but implying the technologist function, in-house materials at the hospitals, and reports of conferences sponsored by government agencies dealing with diagnostic ultrasound practices and objectives.

DESIDERATA

As a result of the lack of uniformity of work and differing levels of tasks assigned to the diagnostic ultrasound technologist, we have had to make some decisions about the way we would present the task descriptions, how we would break down the tasks, and about the practices we would emphasize. HSMS takes sole responsibility for the following decisions, which reflect our "desiderata."

The assignment of ultrasound examination tasks to technologists with diagnostic interpretation done by physicians is an emerging development in the field. The early days of ultrasound saw the examinations carried out by physicians who, in turn, chose individuals to train as technologists. While this process has not occurred everywhere (it may be least apparent in M-mode echocardiography), we chose to describe the technologist function as it will emerge in specialty areas.

We imply that the technologist is someone properly trained to make decisions on whether ultrasound displays are of diagnostic quality; he or she makes preliminary interpretations and selects the technique appropriate for the area of the body being examined, the condition of the patient, the suspected pathology, and the equipment involved. We therefore present tasks for which maximum training at the technologist level would be required. The resulting data provide material for the design of curricula for such levels.

Other decisions that reflect our bias with regard to desirable practice include the following:

1. We suggest that, until a final determination is made about the safety of ultrasound frequencies in the diagnostic range, the performer should proceed as though the exposure could have a negative, cumulative effect. Therefore, we have the performer try, as much as possible, to avoid exposing the patient or self to more ultrasonic energy than is warranted to provide diagnostic information.
2. We have the performer arrange to have the patient attended, cleansed, and/or taken to the next location when appropriate.
3. We have the performer verify the patient's identity.
4. We have the performer treat the patient with sympathy and dignity, and provide the patient with information about what is going on or will go on in the procedure.
5. We have the performer prepared to deal with emergencies.

PRESENTATION OF TASKS

The reader who has not read Chapter 1 of this report is directed to the Introduction and the sections on Task Identification and Description, the HSMS Definition of Task, Reading the Tasks, and Uses of the Task Descriptions and Summaries in Chapter 1, since these apply to the work in ultrasound as well as to radiation therapy technology.

Chapter 5 presents the tasks in numerical order by code number, regardless of whether a task is presented as a detailed task description, as a task summary, or as an extended task name. Where a task is presented as an extended task name and the detailed description appears elsewhere, this is so indicated. (Pagination for Chapter 5 appears at the top of each page.) Below are the abbreviated task names grouped by function and specialty area.

TASKS LISTED BY FUNCTION AND SPECIALTY

Category and Abbreviated Task Name	Task Code No.
EXAMINATION TASKS	
Circulatory System	
Making B-mode scan and A-mode ultrasonograms of any patient's abdominal aorta.	634
Making M-mode echocardiograms of the heart and pericardium of any patient.	635
Making B-scan, A-mode and M-mode ultrasonograms of the fetal heart in utero for calculation of fetal heart rate.	636
Using Doppler ultrasonic motion detector to detect or monitor the fetal heart in utero.	637
Using Doppler ultrasonic motion detector to evaluate blood flow, pressure, occlusion in neonate or any patient.	638
Urinary System and Abdomen	
Making B-scan ultrasonograms of any patient's abdominal contents, such as liver, gallbladder, pancreas, and/or spleen.	625
Making B-scan ultrasonograms of any patient's kidney(s).	626
Nervous System	
Making A-mode echoencephalograms of any patient.	630
Making A-mode and B-mode scan ultrasonograms of a fetal skull in utero.	631
Respiratory System and Thorax	
Making B-scan ultrasonograms of any patient's thoracic contents to study mediastinal masses, pulmonary emboli, pleural lesions, and/or pleural effusion.	627

Category and Abbreviated Task Name	Task Code No.
EXAMINATION TASKS (continued)	
Reproductive System, Fetus	
Making B-scan ultrasonograms of a female patient's pelvis to study reproductive organs, pelvic masses.	624
Making B-scan ultrasonograms of a pregnant patient and fetus.	623
Making A-mode and B-mode scan ultrasonograms of a fetal skull in utero.	631*
Making B-scan, A-mode and M-mode ultrasonograms of the fetal heart in utero for calculation of fetal heart rate.	636*
Using Doppler ultrasonic motion detector to detect or monitor the fetal heart in utero.	637*
Miscellaneous	
Making B-scan ultrasonograms of superficial mass(es) of any patient.	628
Making B-scan ultrasonograms of any patient to differentiate free-fluid from fixed fluid, such as in ascites.	629
EQUIPMENT-RELATED TASKS	
Carrying out standard tests and calibration checks of diagnostic ultrasound equipment.	639

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* Listed also under appropriate system of the body.

TASKS LISTED BY FUNCTION AND SPECIALTY (continued)

Category and Abbreviated Task Name	Task Code No.
EQUIPMENT-RELATED TASKS (continued)	
Loading camera for photography of oscilloscope display; making exposures on orders; recording patient identification, date, series number, level and directional reference.	632
Applying print coater to photographs.	319
PATIENT CARE TASKS	
Reassuring any patient and/or accompanying adult about diagnostic ultrasound procedures and/or explaining prior fluid intake if appropriate.	633
Preparing any patient and attaching electrodes for electrocardiogram monitoring.	520
Escorting adult out-patients to and/or from dressing rooms, treatment rooms and/or waiting areas.	282
Assisting patient to or from wheelchair, stretcher, bed, or table and/or transporting patient to designated area.	190
CLERICAL AND ADMINISTRATIVE TASKS	
Preparing and adjusting schedules for patient procedures.	272
Checking on reasons for nonappearance of in-patients for examinations or treatment.	278
Checking supplies and ordering non-drug materials needed by department.	76
Checking and jacketing patient's radiographs, ultrasonograms, and/or C.T.T. scans with requisition sheets and prior diagnostic materials and placing for filing or interpreting.	78
Logging and/or tallying patient services and/or instructional case record materials for use in record keeping, billing or instruction.	134

TASKS LISTED BY FUNCTION AND SPECIALTY (continued)

Category and Abbreviated Task Name	Task Code No.
CLERICAL AND ADMINISTRATIVE TASKS (continued)	
Obtaining patient records for use in examination, procedure, treatment or conference.	354
Filing or obtaining records from files by patient identification number and/or name.	265
Filling out patient identification information on labels and forms in anticipation of need or as requested.	164
HOUSEKEEPING TASKS	
Preparing treatment or examination room(s) for use.	151
Cleaning an examination or treatment room after use.	135

CHAPTER 5

TASK DESCRIPTIONS, SUMMARIES AND EXTENDED TASK NAMES: DIAGNOSTIC ULTRASOUND TECHNOLOGY

There are 31 diagnostic ultrasound technology task descriptions, task summaries, and extended task names included in this chapter. These are arranged numerically by Task Code Number from Code 76 to Code 639. Extended task names for which task descriptions appear in Volumes 1, 2, or 3 of Research Report No. 7 are so indicated, with the number 7 and the volume number entered in the column on the right. Tasks which overlap with tasks in radiation therapy (presented in Chapter 3 of this report) are indicated by an asterisk. Pagination appears at the top of each page.

TASK CODE	EXTENDED TASK NAME	SOURCE[a]
76	Checking supplies and ordering non-drug materials needed by department by filling out or having co-worker fill out standing orders; taking inventory and ordering items below par levels; noting or asking for requests for items; filling out requisition form or outside order form in duplicate; having orders delivered or placed for pick-up.	7-3 *
78	Checking and jacketing patient's radiographs, ultrasonograms, and/or C.T.T. scans with requisition sheets and prior diagnostic materials and placing for filing or interpreting, by matching films and prints with requisition sheets and any prior diagnostic materials requested; checking for signa-	7-3

(continued)

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[a] The number 7 indicates that the task description appears in one of the volumes of Research Report No. 7: Task Descriptions in Diagnostic Radiology, by Eleanor Gilpatrick, Health Services Mobility Study, 1976. The number following indicates the volume number. An asterisk (*) indicates that the extended task name also appears in Chapter 3 of this report.

TASK CODE	EXTENDED TASK NAME	SOURCE
78	(Continued) tures, proper logging and identification; placing in proper sequence; inserting in jackets and/or envelopes; marking jackets with identification; placing for interpreting or filing.	
134	Logging and/or tallying patient services and/or instructional case record materials for use in record keeping, billing or instruction by obtaining information to be logged and appropriate forms or log book; ascertaining the information to be entered and entering as appropriate; tallying; returning original records; placing log book, tally and/or forms for filing or use as appropriate.	7-3 *
135	Cleaning an examination or treatment room after use by throwing away disposable used materials; wiping away blood and stains using antiseptic solution; replacing linens on treatment table; replacing used or displaced materials; arranging for housekeeping service if needed; returning any documents left in room as appropriate.	7-3 *
151	Preparing treatment or examination room(s) for use by ordering cleaning; checking for proper quantities, whether materials are soiled or expired; restocking or arranging for restocking as needed; discarding expired materials; making sure that equipment is turned off as appropriate; replacing equipment in proper locations.	*
164	Filling out patient identification information on labels and forms in anticipation of need or as requested, by estimating need or referring to standard orders or request; getting information; filling in information; placing for use.	7-3 *
190	Assisting patient to or from wheelchair, stretcher, bed, or table and/or transporting patient to designated area by positioning vehicle, making vehicle stationary during shift, supporting patient; transporting; notifying appropriate personnel when patient arrives; presenting any documents.	7-3 *
265	Filing or obtaining records from files by patient identification number and/or name by obtaining information needed; going to proper files; checking information; pulling or inserting document(s) such as radiographs, test reports from files; placing for use or in patient's folder if appropriate.	*

TASK CODE	EXTENDED TASK NAME	SOURCE
272	Preparing and adjusting schedules for patient procedures by arranging requisitions by type of procedure and assigning times based on urgency, available staff, rooms, time needed for procedure(s), number of patients, and order in which procedures are done; assigning times to patients; recording and posting schedule; adjusting throughout day as appropriate.	7-3 *
278	Checking on reasons for nonappearance of in-patients for examinations or treatment by telephoning wards or floors, recording reasons; presenting complaint if appropriate; posting reasons in designated locations; notifying proper co-worker(s) of need to send someone to transport and/or to reschedule patient(s).	7-3 *
282	Escorting adult out-patients to and/or from dressing rooms, treatment rooms and/or waiting areas, by transporting if necessary; explaining what to remove and what to put on; assisting in dressing and undressing if needed; keeping record of belongings placed in lockers; and returning belongings to patient.	7-3 *
319	Applying print coater to photographs, by obtaining materials; applying coater; placing to dry; writing identification information; placing dried prints for use.	7-3 *
354	Obtaining patient records for use in examination, procedure, treatment or conference by determining the patient records required; checking for presence of documents needed; ordering what is needed from appropriate department orally and/or with requisition sheet; arranging to have records delivered; placing complete set for use as appropriate.	7-3 *
520	Preparing any patient and attaching electrodes for electrocardiogram monitoring, by reviewing orders; attaching electrodes as appropriate; removing when so ordered.	7-3

TASK DESCRIPTION SHEET

Task Code No. 623

This is page 1 of 10 for this task.

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Requisition reviewed; patient reassured, positioned; equipment set up; technique set; preliminary B-scan ultrasonograms made; final scanning planned; scans made, photographed, interpreted during scanning; additional scans made; processed prints identified; interpretation recorded or presented; examination records entered and placed for use.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Patient's ultrasound requisition sheet, ID card, ID bracelet; medical-technical history, prior scans, radiographs; phone; pen; forms; oil or gel; water-coupled or contact ultrasound scanner; ultrasonoscope control panel, viewing screen(s), camera, film, table, transducer; clean linens, towels; waterproof table covering; technique records; emergency cart; stretcher; wheelchair; view boxes;pillow or pad

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Pregnant female patient; physician in charge of diagnostic ultrasound; supervisor; co-worker; nurse; aide;clerical staff

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Making B-scan ultrasonograms of a pregnant patient and fetus by reviewing request; planning scan procedures; setting up equipment; reassuring and preparing patient; making preliminary scans; planning scan angles, levels and technique; interpreting and adjusting to provide diagnostic information while making scans and photographic record; recording or presenting preliminary interpretation; identifying scans; recording examination; placing ultrasonograms for use.

List Elements Fully

Performer receives or obtains the ultrasound requisition form, patient's identification card, and any appropriate medical-technical history for a pregnant female patient scheduled for medical diagnostic ultrasonography in the B-scan mode (echolaminography),in which acoustic energy is used for two-dimensional, cross-sectional medical imaging of the fetus in utero, as a result of:

a. Regular assignment.
b. Checking assignment on schedule sheet.
c. Having arranged requisitions in order of priority.
d. Receiving from co-worker.

1. The ultrasound B-scan equipment may include the use of a contact scanner with an oil or gel to couple the transducer to the body, or a water-coupling ultrasound scanner using a water tank as the coupling agent.

   a. The scanning equipment may use a gray scale image displayed on a scan converter and recorded by photographing the gray scale monitor; gray scale images may be stored with the use of a "floppy disk." Earlier equipment may include time exposure of film and a conventional oscilloscope.

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK DESCRIPTION SHEET (continued)

Task Code No. 623

This is page 2 of 10 for this task.

List Elements Fully

b. The viewing equipment may use visual electronic markers to indicate the time-distance scale, or may use a graticule which is superimposed on the image (a scale on transparent material in the focal plane of the optical instrument).

c. The display image may be recorded with in-camera processed film such as Polaroid camera and film, may use 35mm film in a camera attached to oscilloscope, or floppy disk storage device.

d. The scanning equipment may involve mechanical scanning using preselected levels and intervals and/or may be operated by hand.

2. Performer reads the requisition sheet to determine the examination called for, the patient involved, any special considerations, to plan for the procedure, and to check the completeness of the information provided:

a. Performer reads patient's name, identification number, age, weight, sex. Notes whether patient is in-patient, out-patient, and/or to be treated as emergency patient (such as with bleeding from vagina or imminent labor). Notes the patient's stage of pregnancy.

b. Notes the name of the physician in charge; may note the name of the referring physician; determines to whom the ultrasonograms are to be delivered for interpretation.

c. Performer reviews the examination requested and the purpose, such as determination of fetal head size, maturity, or growth, position of fetus, localization of placenta, detection of ectopic gestation, multiple fetuses, hydatidiform mole, fetal death, or detection of gross fetal abnormalities.

d. Performer may review any relevant diagnostic information so as to anticipate what to watch for in the sonographic imaging.

i) May receive or obtain and review prior ultrasonograms if the procedure is one of a series; may review prior radiographs or radioisotope scans.

ii) May review clinical information on prior pregnancies, such as abortions, terminations, number of live or still births, whether spontaneous or induced labor, method of delivery, whether assisted, condition of neonate, whether breech delivery.

e. If available, performer reviews any record of the technique used for prior sonograms, and standards set for the examination based on the machine to be used; notes any requests on the requisition sheet. Performer may consider any or all of the following options:

i) Particular machine to be used.

ii) Areas to be included in the scans, anatomical reference points, center of reference for viewing and measurement purposes, and patient position.

iii) Use of mechanical versus manual scanning.

iv) Sections, such as transverse and/or longitudinal, and/or oblique; angle of penetration; scan levels; cm distances between scan levels.

v) Ultrasonoscope settings, such as gain curve, background level (for gray scale), use of enlarged or reduced scale (if available).

f. Performer notes any special information, such as collateral condition that will affect patient position-

TASK DESCRIPTION SHEET (continued)

Task Code No. 623

This is page 3 of 10 for this task.

List Elements Fully

ing, technique, or handling of the patient.

i) Notes whether patient will be on a stretcher or in a wheelchair. Notes whether patient will be accompanied by nurse or other staff person.

ii) Notes whether patient has been requested to drink a good deal of liquid and to retain a full bladder prior to the examination.

iii) May check that no barium contrast radiography has been done in the recent past which would leave a residue of radiopaque contrast or gas in the bowel in the plane(s) of interest which would interfere with the accuracy of the ultrasound display. Considers other sources of possible artifacts or location of bones which would interfere with the transmission of the high frequency sound waves.

g. If the performer determines that the request is not properly authorized, is incomplete, that sufficient information is lacking for performer to proceed properly, performer notifies supervisor, physician in charge, or other designated staff person, depending on institutional procedures. Explains the problem if appropriate, and proceeds after obtaining needed information, signature, or orders.

h. If referring physician has requested that ultrasonograms already on file be sent with current scans, and if not already with patient's jacketed material, performer arranges to have prior scans delivered.

i. Performer may prepare appropriate charts and papers (for use in measurement or interpretation) for delivery to physician in charge, or has this done.

List Elements Fully

3. When performer is clear about what will be involved in examination, he or she goes to appropriate room for the equipment required, or notes room assigned on requisition sheet. Prepares ahead so as not to keep patient in examination room longer than necessary. Washes hands as appropriate.

a. If appropriate, checks that the type of transducer appropriate to the examination and mode to be used is attached to the ultrasound scanner. May detach and change transducer. If so, makes sure that electric power is turned off before detaching or attaching the transducer.

b. May make sure that examination room table is provided with disposable and/or waterproof underpadding, or decides to provide personally.

c. Checks for mattress, pads, pillows, and/or blankets for comfort of patient.

d. May prepare identification markers as appropriate to be included on films.

e. Makes sure that the equipment is warmed up and ready for use, and that controls are unlocked.

f. Checks that equipment has been calibrated as appropriate for accurate time-distance measurements, or has this done. If appropriate, records the appropriate correction for the calibration figure for use in making measurements.

g. Makes sure that there is no equipment present that would create an explosive atmosphere.

h. If not already done, performer checks whether camera unit is loaded with adequate film for the procedure. May check film supply indicator or opens back of camera and inspects.

TASK DESCRIPTION SHEET (continued)

Task Code No. 623

This is page 4 of 10 for this task.

List Elements Fully

i) If camera uses Polaroid film holder containing film for several exposures, notes number of unexposed films remaining and provides additional package(s) from storage area. Reloads when appropriate.

ii) If loading Polaroid film package, performer opens camera and package containing film. Handles carefully and removes film pack from bag. Discards any moisture absorbing paper and inserts film pack in camera as appropriate in relation to light shield and restraining spring. Checks position of tabs. Closes camera. Checks and removes safety cover by pulling out by tab. Rechecks and readjusts if needed.

iii) If camera uses roll film and there is insufficient supply in camera, performer arranges to have roll film cassette loaded, or decides to do personally. When loaded roll film cassette is obtained, checks loading in subdued light. May check that end of film is cut correctly and is properly threaded and attached to takeup spool so that film unwinds appropriately. Checks that film is properly engaged in sprockets. Locks into operating position. If appropriate, cuts off excess film at exit port and removes. Attaches film cassette to camera and locks into place. Replaces camera cover.

iv) If there is an adequate film supply, checks that film is properly loaded. Advances film to compensate for any exposure of film due to installation or check. Removes dark slide from camera lens if appropriate.

List Elements Fully

i. Checks that camera is attached and plugged in as appropriate. Sets to appropriate operating position.

j. Determines appropriate preliminary control settings based on posted charts for the equipment and examination, record of past scans, specific orders, or own experience. Considers that resolution (definition) increases with frequency, and penetration decreases with frequency, and that sensitivity is a function of the signal-to-noise ratio. Considers that the more superficial the structure, or the closer the transducer to the target area of interest, the higher the frequency possible for definition, while the longer wavelengths needed for greater penetration mean loss of resolution. Considers the sound densities of the tissues to be encountered.

k. Sets control settings selected as appropriate to the equipment being used for preliminary scanning:

i) Sets gain as appropriate; may set to display gain curve; sets for B-scan mode. Selects and sets vertical and horizontal positions; sets electronic depth marker as appropriate.

ii) Performer may adjust intensity controls until the baseline just disappears. For gray scale may adjust sensitivity control until the background level is barely visible with no echoes present.

iii) May adjust focus and astigmatism or equivalent controls so that the dots on the display are most sharp. Sets illumination of the graticule scale as appropriate.

iv) May use output control to affect echo strength (without affecting gain setting).

TASK DESCRIPTION SHEET (continued)

Task Code No. 623

This is page 5 of 10 for this task.

List Elements Fully

- l. Sets scanning arm for programmed cm steps or for manual control.
- m. For water-coupling scanner, may check that water tank is filled and at body temperature. For contact scanner, checks that gel or mineral oil is present as coupling agent.
- n. May check that emergency cart and equipment are available for use in the case of onset of labor, bleeding, breaking of "bag of waters." Checks for stethescope. May place clean disposable and/or waterproof underpadding on table.
- o. Performer may check all mechanical functions, such as automatic scanning arm, traversing table, and display functions to be sure that all components are functioning properly. Makes sure that all controls are in start position.
- p. If performer decides that any of the equipment is not functioning properly, or is not ready for use, informs appropriate staff member and proceeds as ordered, or notifies service organization.

4. Performer has the patient called from the holding area and prepared for the examination (if not already done), or decides to do personally.

   - a. Performer washes hands as appropriate.
   - b. Depending on institutional arrangements, performer may decide to escort out-patient to or from dressing room. May decide to assist in transporting patient from holding area or has this done.
   - c. Performer greets patient and any accompanying staff person and introduces self. Checks patient's identity against the requisition sheet. With in-patient, checks hospital identification bracelet or other identifier. If patient is accompanied because of seriousness of condition or imminence of labor, performer checks with accompanying staff member on any special precautions necessary during procedure.
   - d. If not already done, has patient's clothing removed and provides gown or drape. May assist patient or request assistance from nurse.
   - e. If patient is to be examined with a contact scanner, has patient lie in supine position on examination table.

     - i) If patient is in wheelchair, may move patient in chair into position next to table. Makes sure that wheelchair is in locked position. May decide to assist patient from wheelchair or stretcher to table or has this done. May obtain help.
     - ii) Makes sure that no equipment is in the way that may be collided with by patient.
     - iii) If assisting patient to step on footstool in order to get on table, helps patient turn into position, step backwards on stool, and then sit and/or lie on table.
     - iv) If patient is on special stretcher, places stretcher into position so that is can be lifted with patient on it from wheeled base to table. May arrange to move or have patient moved to table.

   - f. With water-coupling scanner, prepares to have patient stand on the platform of a tilt table. Has patient relax on table until scanning is about to begin.
   - g. If not already done, performer questions patient or accompanying staff member about any preparatory intake of fluids. Observes or asks about fullness of bladder. If liquids have not been drunk and blad-

TASK DESCRIPTION SHEET (continued)

Task Code No. 623

This is page 6 of 10 for this task.

List Elements Fully

der is not distended, and this is essential for examination (such as placenta localization), performer may arrange to have liquids administered. May postpone examination or check with physician in charge on whether to go ahead.

h. Performer explains to patient what will be involved in the procedure:

  i) May explain what ultrasound is in contrast to other forms of imaging, that it is painless. May demonstrate how the equipment will be functioning without exposing patient to actual ultrasound waves.
  ii) Describes what will happen and the need to use a lubricating coupling agent (or the water tank couplant).
  iii) Explains what cooperation will be asked of patient. Explains the need for patient to retain a full bladder for the examination even if this is uncomfortable. Explains the need to have patient hold her breath when requested. May have patient practice inhaling deeply several times when asked and then breathing in and holding until asked to relax. Has patient practice noticing when the fetus is quiet and informing performer.
  iv) Performer answers patient's non-medical questions honestly; attempts to reassure patient and develop confidence. Treats patient with dignity and concern regardless of patient's behavior. Remains aware that patient may be frightened, uncomfortable and/or in pain. Performer explains, when asked medical questions, that it is not appropriate for technologist to answer these; encourages patient to speak to physician.

List Elements Fully

i. If patient is not accompanied by a nurse, performer may check with patient who may be starting labor on regularity of contractions. May place hand on patient's abdomen just above umbilicus to feel contractions. Encourages patient to inform performer if the contractions become regular or increase in duration.

  i) If there is any sign that onset of labor has begun, performer immediately informs appropriate staff and works as rapidly as possible until told to stop. Avoids any contact of nonsterile objects with patient's vaginal area. Reassures patient and helps make her as comfortable as possible.
  ii) If patient is accompanied by nurse(s), continues procedure unless told to stop, and assists with care of patient as directed.

j. For contact scanning performer exposes the patient's abdomen so that all the skin over which the transducer will be passed is accessible. Performer obtains the mineral or paraffin oil or gel to be used as a couplant and applies this gently, covering the entire area.

5. Performer sets up for the preliminary scanning:

  a. For water-coupling scanner, has patient stand on the platform of the tilt table and press her abdomen against the window of the coupling tank containing the water. Tilts table so that the long axis of the uterus will be at right angles to

TASK DESCRIPTION SHEET (continued)

Task Code No. 623

This is page 7 of 10 for this task.

List Elements Fully

the transverse plane to be scanned.

b. For contact scanning, aligns patient in supine AP position on examination table.

c. Performer may mentally refer to the area to be scanned in terms of four quadrants created by two lines intersecting at right angles at the umbilicus.

d. Performer plans the scanning ahead as much as possible to avoid exposing the patient to more ultrasonic energy than is warranted to provide diagnostic information. Until a final determination is made about the safety of ultrasound exposures in the diagnostic range, performer proceeds as though the exposure could have a negative, cumulative effect. Is careful in exposing both self and the patient without causing alarm in the patient.

e. If the table will move automatically as programmed, positions table so that the scanning arm will move across the first scan area as planned. Adjusts table height as appropriate.

  i) Moves the scanning arm into position. If appropriate engages the scanning arm and table moving mechanisms.
  ii) Positions the transducer at the center of the area of interest to check centering of image,or places the transducer at the extreme right or left, or caudal or cephalad end of the first scan, depending on whether it will be transverse or longitudinal.
  iii) Adjusts angulation if appropriate for oblique scanning.

6. Performer proceeds to image the area of interest with preliminary scans in order to localize area of interest, evaluate whether the bladder is sufficiently distended for good results, to determine best scan levels, angles and intervals, and to adjust the controls for best diagnostic results.

a. Performer carries out rapid scanning by forming and erasing the images in fast sequence to image the entire area of interest and form a general impression.

b. With contact hand scanning, places transducer in contact with the patient's skin. May move transducer along the plane of interest using a slight rocking motion unless preference is for simple rather than compound scan motion.

  i) Moves the transducer in one horizontal or vertical direction, maintaining contact with the patient's skin.
  ii) Avoids passing the transducer back and forth over an area so as not to fill the image.

c. Performer evaluates the display and makes readjustments in the gain setting if so decided. May adjust brightness, focus or resolution as appropriate.

d. Before each new scan uses controls to erase the image being displayed.

e. Makes several scans to determine the location of the area of interest in relation to other organs, and the levels to include. Watches for the characteristic forms such as bladder, fetal head, placenta.

f. Makes preliminary observations on any obvious pathology or areas requiring further examination.

g. Watches for areas which are obscured by gas or bone.

h. Watches for reverberation artifacts.

i. Performer determines whether equipment is functioning properly, whether the patient's bladder is sufficiently distended. Decides on technique and how to proceed.

TASK DESCRIPTION SHEET (continued)

Task Code No. 623

This is page 8 of 10 for this task.

List Elements Fully

j. May discontinue procedure and report malfunction, or arrange to have patient drink liquids or be rescheduled as appropriate. Explains what is involved to patient. May consult supervisor or physician in charge.

7. If the patient and equipment are ready for the ultrasound scanning to be recorded, performer sets controls for image storage and photographic recording and proceeds to make each scan as determined.

   a. While viewing on screen, performer judges whether each image being produced provides adequate information on the basis of which the physician can come to diagnostic conclusions.
   b. When a particular scan level with precise detail is required, performer may ask patient to indicate when fetus is quiet, and asks patient to hold breath during the scan.
   c. When performer judges that an image is of diagnostic quality, performer operates camera exposure control to take picture of display, or has co-worker operate camera.
   d. Performer may make a series of scans which include the entire area of interest from the point where its extreme boundary just comes into view, to the opposite end, spaced at predetermined cm intervals. May then make several scans at right angles.

      i) Performer may use a high gain setting to identify the placenta as a plate-like interface, with echoes arising within the area as the gain is increased.
      ii) May seek the fetal head midline echo pattern and position the transducer in relation to it in order to make right angle scans of the fetal head and to obtain precise measurement records.

List Elements Fully

      iii) May note possible fetal death if the image shows a blurred fetal outline.

   e. During scanning, performer considers whether the anatomical forms under study are clearly delineated in the image displays.

      i) Considers whether any abnormalities appear to be present, whether reverberation artifacts are present.
      ii) Considers the normal outline of the organ and the manner in which any pathological structures or processes would appear on the ultrasound image. Translates the two dimensional image in terms of the three dimensional anatomy involved.
      iii) Performer may change gain settings during scanning from low to high to note whether characteristic changes take place that are of diagnostic significance.
      iv) Considers whether any apparent abnormalities should be further investigated. Considers the best levels and angles for additional scans.
      v) Encourages patient to retain urine in bladder.

   f. Performer makes a photographic record of each scan deemed adequate for diagnostic purposes and interpretation by the physician in charge.

      i) Unless carried out by co-worker, if Polaroid or other automatic processing camera is used, waits for exposure to be completed; pulls out tabs as appropriate, and waits for film processing to take place. Peels off or separates developed print from nega-

TASK DESCRIPTION SHEET (continued)

Task Code No. 623

This is page 9 of 10 for this task.

List Elements Fully

tive without letting print come in contact with negative. Discards tabs and negative as appropriate, avoiding any contact with caustic jelly. May fold and wrap negative to discard.

ii) Continues with additional photographs as described.

iii) If roll film is used, when all photographs have been taken, may remove as appropriate and place for processing, or decides to do personally.

iv) When each processed photograph is ready, checks that photo has the same appearance as the display being viewed. If not, reports to proper staff member.

v) If the film used requires a coat of fixer, may accumulate the developed photographs and have them coated with fixer, or decides to do personally.

vi) If, during the course of procedure, camera needs reloading, performer reloads Polaroid pack or roll film as described.

vii) Unless identification information is photographed with display, performer records the patient's name, identification number, the date, the right-left or anatomical reference direction, the level; may number the scans in sequence. May record technical settings.

g. Performer may decide to use special features when available, such as electronic depth marker for accurate measurement, or to magnify an area of interest on the display.

8. When performer judges that all permanent scan records have been made, performer may record his or her preliminary interpretation of the images and the reasons for making particular scans.

List Elements Fully

a. May record technical factors, level of scan, and related comments so as to help develop a standardized technique for the examination.

b. If performer judges that an emergency condition may be present, notifies physican in charge at once.

c. Performer bases interpretations on examination of the whole set of ultrasonograms, referring to the appearance and shape of the structure as it is first seen, as it develops, reaches maximum dimensions, and then disappears from the display.

d. Performer may comment on artifacts, such as point at which an echo arises from the interface between the crystal and the skin surface, or reflections of other organs.

e. If appropriate, performer may show ultrasonograms to attending physician and discuss interpretation before discharging patient. May repeat scans or make specific scans as ordered. If so, proceeds as described above.

9. Throughout procedure performer observes patient for any signs of emergency and/or to prevent or respond to an accident. Is alert to signs of onset of labor such as irregular contractions becoming regular, or rupture of "bag of waters."

a. If the amniotic membranes rupture and there is a watery gush of fluid from the vagina, performer does not attempt to wipe away secretions from vagina unless sterile procedure can be followed. If patient is not in care of nurse, performer may proceed as follows:

i) Reports at once to proper staff member.

ii) Keeps patient lying down.

TASK DESCRIPTION SHEET (continued)

Task Code No. 623

This is page 10 of 10 for this task.

List Elements Fully

iii) Places clean towel under buttocks to absorb moisture.

b. If patient is accompanied by nurse, assists as appropriate unless told to terminate.

c. If patient shows any other emergency signs, loses consciousness, or has an accident, performer calls appropriate physician or staff member at once.

10. When performer determines that the examination has been completed, performer carries out termination steps for the examination:

a. Performer gently removes gel or mineral oil from patient or has this done.

b. Performer may assist patient from table. Makes sure patient is reminded of any footrest in stepping off table. Makes sure that none of the equipment is projecting over the patient before allowing patient to rise from table, and assists patient. May assist patient to bathroom to empty bladder.

c. Performer may have patient transported to next assigned location, or to area to put on street clothes,or decides to do personally, as appropriate. If appropriate, makes sure that patient is in the care of staff person who will transport to appropriate next location or, if out-patient, will arrange to discharge or send patient home, with escort if appropriate.

d. Performer may have room and equipment cleaned; has secretions removed with disinfectant; may decide to do personally. Has any other appropriate clean-up procedures followed to avoid infection or contamination, or decides to do personally, depending on institutional procedures.

List Elements Fully

e. Performer records the examination according to institutional procedures. May include date, machine, examination type, number of scans recorded, levels, cm intervals, sections, technical settings. May record any problem with equipment, any special care provided patient. Signs requisition sheet.

f. May present requisition form to physician for comments and signature.

g. Performer may decide to jacket ultrasonograms, requisition sheets, preliminary notes, own interpretations, and related materials. May have information recorded in log book. May decide to do personally or has this done, depending on institutional procedures. Makes sure that identification information and the scan sequence number are marked on each ultrasonogram and that the scans are in proper sequence.

h. May indicate to appropriate staff person when the performer is ready to proceed with next examination.

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
Code 624 This is page 1 of 4 for this task.

Performer's Name________________ Analyst(s)________________ Dept.________
Job Title________________ Institution________________ Date________

1. **What is the output of this task?** (Be sure this is broad enough to be repeatable.)

Requisition reviewed; patient reassured,positioned; equipment set up; technique set; preliminary B-scan ultrasonograms made; final scanning planned; scans made, photographed, interpreted during scanning; additional scans made; processed prints identified; interpretation recorded or presented; examination records entered and placed for use.

2. **What is used in performing this task?** (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Patient's ultrasound requisition sheet, ID card, ID bracelet, medical-technical history, prior scans, radiographs; phone; pen; forms; oil or gel; contact ultrasound scanner, ultrasonoscope control panel, viewing screen(s), camera, film, table, transducer; linens, towels; technique records; stretcher; wheelchair; view boxes;pillow or pad

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. **If "Yes" to q. 3:** Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Female patient; physician in charge of diagnostic ultrasound; supervisor; co-worker; nurse;aide; clerical staff

5. **Name the task** so that the answers to questions 1-4 are reflected. Underline essential words.

Making B-scan ultrasonograms of a female patient's pelvis to study reproductive organs, pelvic masses by reviewing request; planning scan procedures; setting up equipment; reassuring and preparing patient; making preliminary scans; planning scan levels, angles, technique, patient positions; interpreting and adjusting to provide diagnostic information while making scans and photographic records; recording or presenting preliminary interpretation; identifying scans; recording examination; placing ultrasonograms for use.

List Elements Fully

Performer receives or obtains the ultrasound requisition form, patient's identification card, and any appropriate medical-technical history for a female patient scheduled for medical diagnostic ultrasonography in the B-scan mode (echo-laminography) in which acoustic energy is used for two-dimensional,cross-section medical imaging of the female reproductive system (pelvis) as a result of:

a. Regular assignment.
b. Checking assignment on schedule sheet.
c. Having arranged requisitions in order of priority.
d. Receiving from co-worker.

1. The ultrasound B-scan equipment includes a contact scanner with use of an oil or gel to couple the transducer to the body.
   a. The scanning equipment may use a gray scale image displayed on a scan converter and recorded by photographing the gray scale monitor; gray scale images may be stored with the use of a "floppy disk." Earlier equipment may include time exposure of film and a conventional oscilloscope.
   b. Measurements of distance (calibrated to the time delay of the echoes) may be determined from a graticule superimposed on the image, or from electronic markers.

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 2 of 4 for this task.

Code 624

Performer's Name__________________ **Analyst(s)**__________________ **Dept.**________
Job Title__________________ **Institution**__________________ **Date**________

List Elements

c. The display image may be recorded with in-camera processed film, roll film in camera attached to oscilloscope, or floppy disk storage device.

d. The scanning options may include programmed mechanical scanning at predetermined levels and cm intervals between scans, or may be done by manual movement of the transducer across the patient's body.

2. This task follows the general outline of Task Code 623. General initial steps include finding out the examination and diagnostic ultrasound mode called for, the patient involved, the physician in charge, details of the examination requested, any special considerations, and overall planning and preparation for the procedure:

   a. Performer reviews the examination options requested or considered to be standard for the examination to be done.
   b. Reviews the organ of interest, the suspected condition, the purpose of the examination, clinical background, prior scans, radiographs, and/or other diagnostic information.
   c. Considers the patient position, technical settings, sections (transverse and/or longitudinal, and/or special oblique planes), levels, cm intervals, and angulation required.

      i) Reviews standard orders, request on requisition, or own experience with regard to technique appropriate for the organs to be examined and the condition to be detected.
      ii) Considers how to obtain the characteristic images that will produce diagnostic information.
      iii) Considers the particular type of artifacts or obstructing structures associated with the organs being examined, such as gas in the bowel, fluid in the stomach or bladder, overlying of one organ by another, reverberation artifacts reflecting tissue interfaces where none exist.

   d. Considers orders for prior intake of fluid by patient so that patient will have a distended bladder during the examination. Considers any collateral clinical condition affecting handling of patient.
   e. If appropriate, discusses case with physician in charge to obtain further information or to clarify what is required, or to obtain signature.
   f. Prepares equipment and materials ahead as in Task Code 623 so as not to keep patient in examination room longer than necessary.

3. This task follows the patient preparation and examination steps of Task Code 623 in the following general areas:

   a. Observes sanitary precautions. Arranges to have patient brought to area and prepared for examination.
   b. Explains to patient what will happen, how to cooperate, how to hold breath.

      i) Reassures patient and establishes a caring, professional relationship.
      ii) Applies mineral or paraffin oil or gel to the skin over the entire area to be scanned.

   c. Positions patient and equipment. Adjusts technical settings for preliminary scanning.
   d. Makes preliminary scans to locate the organ to be examined, evaluate the extent to which it is obscured, plan the best technique and the

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
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List Elements

planes to scan in order to visualize the area of interest. Has patient hold breath during scanning.

i) Considers the diagnostic meaning of mass forms and organs, of cystic forms and fluid filled organs based on the location of the mass in the pelvic cavity.
ii) Considers possible artifacts. Notes areas of interest that should be investigated in detail.

e. Treats scanning procedure as though the acoustic energy at diagnostic frequencies could be cumulatively harmful; therefore,avoids any unnecessary exposure of patient or self beyond what is needed to provide adequate information for diagnostic purposes.
f. Carries out ultrasound scanning as determined:

i) Observes image on display and makes photographic record of each scan pass, so that a series is produced from the point where the structure being studied is first seen, as it develops, at its full cross-section dimensions,and as it disappears from the display.
ii) May repeat with longitudinal right angle or oblique sections.
iii) During scanning performer interprets the structures being seen in order to modify the technical settings, angle and/or level of the scan to bring out and display relevant diagnostic information. Bears in mind the characteristic images produced by the relevant healthy or diseased structures and their appearance at given sensitivy or gain settings.
iv) For observed masses, performer may examine the outlined mass at a variety of gain settings, using low gain to obtain information about the size and depth of the mass, and higher gain to differentiate a cystic from a tumor mass.
v) Checks for echo-free zone and strong back-wall echoes as cystic pattern.
vi) Checks for multiple echoes, weak back-wall echo at low and high gain, and incomplete filling in of echo-free zone at high gain as solid mass pattern.
vii) Checks for strong back-wall echoes and scattered echoes within the echo-free zone at high gain as necrosis or loculations (structurally complex mass with fluid) pattern.
viii) Notes the contour of the mass; considers that smooth walls are often a characteristic of benign lesions and irregular walls more likely to indicate a malignancy.
ix) During scanning may modify scanning planes and technical setting based on own judgment of what is being observed. Photographs displays as described.

g. Makes sure to properly process and identify each scan print or has this done; marks scans in sequence as well as with information on patient, date, level, section, right-left or longitudinal reference, and technical settings.
h. May record preliminary interpretation of scans.
i. As appropriate, responds to emergency situation; reassures patient.
j. May bring ultrasonograms to physician for immediate review and further orders.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
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i) Reports emergency signs at once.
ii) May present interpretation of scans orally.
iii) May continue as ordered.

k. When examination is completed, removes oil or gel from patient's body. Assists patient to leave. Makes sure that patient is escorted or directed to next location or properly discharged.
l. Records examination as appropriate.
m. Provides for clean-up of equipment, jacketing of scans, placement of all records for use as appropriate.

4. Unique features of this task are as follows:

a. Purpose of the examination may include detecting pelvic masses, solid versus cystic tumors, diagnosis of early pregnancy, location of intrauterine device.
b. Performer may check on whether a condition exists or a prior diagnostic procedure may have been done recently that may interfere with the penetration of the ultrasound beam, such as a gas filled bowel, barium contrast within colon. Considers the best angle of approach to avoid bone such as pelvic bones, or gases such as in gastrointestinal tract.
c. Performer may start the preliminary transverse sweeps at about the level of the symphysis pubis, moving cephalad until the lower edge of the area of interest is identified, or caudad if the organ is encountered at the first sweep plane, until the lowest border is encountered.
d. For pelvic masses, performer proceeds as described earlier, above.
e. For locating intrauterine device (in uterus or in abdominal cavity), performer looks for strong echoes reflected by the device.

List Elements

f. If there is the possibility of early pregnancy, looks for a ring-like configuration within the uterus representing the gestational sac.

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
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Code 625

Performer's Name________________ Analyst(s)________________ Dept.________
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1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Requisition reviewed; patient reassured, positioned; equipment set up; technique set; preliminary B-scan ultrasonograms made; longitudinal axis of organ noted or marked on patient; final scanning planned; scans made, photographed, interpreted during scanning; fatty meal given; additional scans made; processed prints identified; interpretation recorded or presented; examination records entered and placed for use.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Patient's ultrasound requisition sheet, ID card, ID bracelet, medical-technical history, prior scans, radiographs; phone; pen; forms; oil or gel; wax or dye marker or metal markers; contact ultrasound scanner, ultrasonoscope control panel, viewing screen(s), camera, film, table, transducer; linens, towels; technique records; stretcher; wheelchair; view boxes; watch or clock

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Any patient; physician in charge of diagnostic ultrasound; supervisor; co-worker; nurse; clerical staff

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Making B-scan ultrasonograms of any patient's abdominal contents, such as liver, gallbladder, pancreas, and/or spleen by reviewing request; planning scan procedures; setting up equipment; reassuring and preparing patient; making preliminary scans; marking longitudinal axis of organ on patient; planning scan levels, angles, technique, patient positions; interpreting and adjusting to provide diagnostic information while making scans and photographic records; arranging for fatty meal if appropriate for gallbladder scans; making post fatty meal scans as ordered; recording or presenting preliminary interpretation; identifying scans; recording examination; placing ultrasonograms for use.

List Elements

Performer receives or obtains the ultrasound requisition form, patient's identification card, and any appropriate medical-technical history for any patient scheduled for medical diagnostic ultrasonography of the abdominal cavity in the B-scan mode to study abdominal contents such as the liver, gallbladder, pancreas, or spleen, as a result of:

a. Regular assignment.
b. Checking assignment on schedule sheet.
c. Having arranged requisitons in order of priority.
d. Receiving from co-worker.

1. The ultrasound B-scan equipment includes a contact scanner with use of an oil or gel to couple the transducer to the body.

   a. The scanning equipment may use a gray scale image displayed on a scan converter and recorded by photographing the gray scale monitor; gray scale images may be stored with the use of a "floppy disk." Earlier equipment may include time exposure of film and a conventional oscilloscope.
   b. Measurements of distance (calibrated to the time delay of the echoes) may be determined from a graticule superimposed on the image, or from electronic markers.

OK-RP;RR;RR

6. Check here if this is a master sheet..(x)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
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List Elements

c. The display image may be recorded with in-camera processed film, roll film in a camera attached to oscilloscope, or floppy disk storage device.

d. The scanning options may include programmed mechanical scanning at predetermined levels and cm intervals between scans, or may be done by manual movement of the transducer across the patient's body.

2. This task follows the general outline of Task Code 623. General initial steps include finding out the examination and diagnostic ultrasound mode called for, the patient involved, the physician in charge, details of the examination requested, any special considerations, and overall planning and preparation for the procedure:

a. Performer reviews the examination options requested or considered to be standard for the examination to be done.

b. Reviews the organ of interest, the suspected condition, the purpose of the examination, clinical background, prior scans, radiographs, and/or other diagnostic information.

c. Considers the patient position, breath control, technical settings, sections (transverse and/or longitudinal, and/or special oblique planes), levels, cm intervals and angulation required.

i) Considers location of organ in relation to patient bodily habitus.

ii) Reviews standard orders, request on requisition, or own experience with regard to technique appropriate for the organs to be examined and the condition to be detected.

iii) Considers how to obtain the characteristic images that will produce diagnostic information.

List Elements

iv) Considers the particular type of artifacts or obstructing structures associated with the organ being examined, such as gas in the bowel, fluid in the stomach or bladder, overlying of one organ by another, reverberation artifacts reflecting tissue interfaces where none exist.

d. Considers any collateral patient condition affecting handling of patient.

e. If appropriate, discusses case with physician in charge to obtain further information or to clarify what is required, or to obtain signature.

f. Prepares equipment and materials ahead as in Task Code 623 so as not to keep patient in examination room longer than necessary.

3. This task follows the patient preparation and examination steps of Task Code 623 in the following general areas:

a. Observes sanitary precautions. Arranges to have patient brought to area and prepared for examination.

b. Explains to patient what will happen.

i) Reviews any breath control to be used, positions, how patient can cooperate.

ii) May evaluate body type to estimate location of organs which depend on body type, such as gallbladder, pancreas.

iii) Reassures patient and establishes a caring, professional relationship.

iv) Applies mineral or paraffin oil or gel to the skin over the entire area to be scanned.

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Performer's Name____________ Analyst(s)____________ Dept.________
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List Elements

c. Positions patient and equipment. Adjusts technical settings for preliminary scanning.

d. Makes preliminary scans to locate the organ to be examined, evaluate the extent to which it is obscured, plan the best technique and the planes to scan in order to visualize the area of interest.

 i) Considers the diagnostic meaning of mass forms and organs, of cystic forms and fluid filled organs based on the location of the mass in a given abdominal quadrant and the probable location of the organ given the bodily habitat of the patient and the patient's age.

 ii) Considers possible artifacts. Notes areas of interest that should be investigated in detail.

 iii) May mark the lateral and medial edges of the organ at each transverse scan level by noting position of transducer when the leading edge of the scan display marks the border. Uses a wax or dye marker or metal markers. Connects marks when done to indicate the lateral and medial boundaries of organ for longitudinal scanning.

e. Treats scanning procedure as though the acoustic energy at diagnostic frequencies could be cumulatively harmful; therefore, avoids any unnecessary exposure of patient or self beyond what is needed to provide adequate information for diagnostic purposes.

f. Carries out ultrasound scanning as determined:

 i) Observes image on display and makes photographic record of each scan pass, so that a series is produced from the point where the structure being studied is first seen as it develops, at its full cross-section dimensions, and as it disappears from the display.

 ii) May repeat with longitudinal right angle or oblique sections.

 iii) During scanning performer interprets the structures being seen in order to modify the technical settings, angle, and/or level of the scan to bring out and display relevant diagnostic information. Bears in mind the characteristic images produced by the relevant healthy or diseased structures and their appearance at given sensitivity or gain settings.

 iv) For observed masses, performer may examine the outlined mass at a variety of gain settings, using low gain to obtain information about the size and depth of the mass, and higher gain to differentiate a cystic from a tumor mass.

 v) Checks for echo-free zone and strong back-wall echoes as cystic pattern.

 vi) Checks for multiple echoes, weak back-wall echo at low and high gain, and incomplete filling in of echo-free zone at high gain as solid mass pattern.

 vii) Checks for strong back-wall echoes and scattered echoes within the echo-free zone at high gain as necrosis or loculations (structurally complex mass with fluid) pattern.

 viii) Notes the contour of the mass; considers that smooth walls are often a characteristic of benign lesions and irregular walls more likely to indicate a malignancy.

 ix) During scanning may modify scanning planes and technical setting based on own judgment of what is being observed. Photographs displays as described.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
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Performer's Name__________ Analyst(s)__________ Dept.__________
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List Elements

g. Makes sure to properly process and identify each scan print or has this done; marks scans in sequence as well as with information on patient, date, level, section, right-left or longitudinal reference, and technical settings.

h. May record preliminary interpretation of scans.

i. As appropriate, responds to emergency situation; reassures patient.

j. May bring ultrasonograms to physician for immediate review and further orders.

   i) Reports emergency signs at once.
   ii) May present interpretation of scans orally.
   iii) May continue as ordered.

k. When examination is completed, removes oil or gel from patient's body. Assists patient to leave. Makes sure that patient is escorted or directed to next location or properly discharged.

l. Records examination as appropriate.

m. Provides for clean-up of equipment, jacketing of scans, placement of all records for use as appropriate.

4. Unique features of this task are as follows:

a. Purpose of the examination may include differentiating suspected masses, such as pancreatic pseudocysts, to measure the gallbladder, to evaluate conditions of the liver, gallbladder, pancreas, or spleen, or other abdominal organs.

b. Prior considerations include noting any orders for fatty meal, post-fatty meal and post-evacuation ultrasonograms of the gallbladder. Performer may check on whether a condition exists or a prior diagnostic procedure may have been done recently that may interfere with the penetration of the ultrasound beam, such as a gas filled bowel, barium contrast within colon. Considers the best angle of approach to avoid bone, such as ribs or pelvic bones, or gases, such as in gastrointestinal tract.

c. Scanning techniques to overcome ultrasound impedance may include using the transducer as a compression device gently to move the bowel aside. Avoids applying pressure to areas where the organ being examined is just beneath the abdominal wall and the contour is of importance, such as the gallbladder.

d. For the organs in the upper abdominal cavity, performer may start the preliminary transverse sweeps at about the level of the umbilicus, moving cephalad until the lower edge is identified, or caudad if the organ is encountered at the first sweep plane, until the lowest border is encountered.

e. For the liver, may note that the large size of the organ may result in a relatively echo-free zone, with tumor or cirrhosis of the liver both producing echoes. Uses high gain to identify abscesses or cysts.

   i) Enlists patient's assistance in holding breath during scanning.
   ii) If there is request to prepare dimensional information for percutaneous liver biopsy, makes scans that will provide the spatial coordinates for accurate needle placement.
   iii) After the right lobe has been visualized, performer may make slightly oblique transverse scans to follow the planes of the organ. May note that upper portion of liver may be partly obscured by lungs and ribs.

TASK IDENTIFICATION SUMMARY SHEET (continued)

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List Elements

iv) Makes longitudinal scans referenced from the median sagittal plane. May concentrate on imaging the portions obscured in the transverse scans. May gently depress the abdominal wall below the lower edge of the liver with transducer and scan at a wide angle towards the head, so that the ultrasonic beam traverses liver tissue rather than lung tissue.

f. For the gallbladder, searches for an echo-free zone in the right upper quadrant and takes account of the body type of the patient.

i) May carry out scanning at end of patient inspiration while patient holds breath.
ii) Uses technique appropriate to fluid-filled structures. Is careful not to distort image by pressing down with transducer on the anterior abdominal wall.
iii) May search for the gallbladder in relation to its position along the medial aspect of the liver.
iv) During transverse scanning, may mark patient's skin with wax or dye marker, or with metal markers to indicate topographic boundaries of gallbladder in preparation for longitudinal scans. Marks the long axis of the gallbladder and/or lateral and medial transverse borders.
v) Carries out longitudinal scans following markings.
vi) If a fatty meal has been ordered, performer has orders carried out and patient given meal or fed as appropriate. May decide to do personally.
vii) If patient may leave the department for meal, performer makes sure that patient or accompanying adult knows exact time to return.

List Elements

viii) With in-patient, may arrange to have nursing staff in charge of patient's care informed. Performer may arrange to have patient taken to appropriate holding area. Keeps track of the time elapsed. If appropriate, makes sure that patient is in the care of a staff person who will transport to appropriate location and return patient at appropriate time.
ix) After patient has had fatty meal and after appropriate elapse of time, performer has patient returned and prepared (or prepares) as appropriate for ultrasound scanning of the contracting gallbladder. Makes post-fatty meal ultrasonograms. Makes sure that each scan print is marked to include the post-meal time interval.
x) If appropriate, repeats after proper time elapse,making post-evacuation ultrasonograms of the gallbladder.

g. For the pancreas, searches for location by considering normal variability in location and relationship to other organs.

i) Uses technique appropriate to a fibrous structure.
ii) Performer may mark patient's skin as described earlier to outline the longitudinal axis of the pancreas.
iii) Carries out oblique scanning along the marked plane if there are signs of abnormality in the head and/or body of the pancreas or if so ordered. Uses the overlying liver structures for directing the ultrasound beam rather than the air-filled stomach.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
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Performer's Name ____________ Analyst(s) ____________ Dept. ________
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List Elements	List Elements
iv) May have patient assume prone position for evaluating the structures in the tail of the pancreas; uses the kidney as the sound medium. Bears in mind that any fluid present in stomach will pool anterior to left kidney in prone scans. h. For the spleen, considers that it can appear as a fluid-filled mass or a complex mass, may be enlarged, may contain a relatively large amount of fluid which can produce an echo-free zone. i) May carry out prone transverse scans at small intervals to obtain good detail after locating spleen. May make longitudinal scan positioned to display the medial surface of the spleen, angled so as to include the most caudal tip of the spleen. ii) May place patient in right lateral decubitus position and make a longitudinal scan along the patient's flank. iii) Performer attempts to pass the transducer to sufficiently lateral extents in each scan to direct the sound beam at right angles to the principle surfaces of the spleen.	

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
Code 626
This is page 1 of 5 for this task.

Performer's Name________________ Analyst(s)________________ Dept.________
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1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Requisition reviewed; patient reassured, positioned; equipment set up; technique set; preliminary B-scan ultrasonograms made; longitudinal axis of kidney(s) noted or marked on patient; final scanning planned; scans made, photographed, interpreted during scanning; additional scans made; processed prints identified; interpretation recorded or presented; examination records entered and placed for use.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Patient's ultrasound requisition sheet, ID card, ID bracelet, medical-technical history, prior scans, radiographs; phone; pen; forms; oil or gel; wax or dye marker or metal markers; contact ultrasound scanner, ultrasonoscope control panel, viewing screen(s), camera, film, table, transducer; linens, towels; technique records; stretcher; wheelchair; view boxes

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Any patient; physician in charge of diagnostic ultrasound; supervisor; co-worker; nurse

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Making B-scan ultrasonograms of any patient's kidney(s) by reviewing request; planning scan procedures; setting up equipment; reassuring and preparing patient; making preliminary scans; marking longitudinal axis of kidney(s) on patient; planning scan levels, angles, technique, patient positions; interpreting and adjusting to provide diagnostic information while making scans and photographic records; recording or presenting preliminary interpretation; identifying scans; recording examination; placing ultrasonograms for use.

List Elements

Performer receives or obtains the ultrasound requisition form, patient's identification card, and any appropriate medical-technical history for any patient scheduled for medical diagnostic ultrasonography of the kidney(s) in the B-scan mode as a result of:

a. Regular assignment.
b. Checking assignment on schedule sheet.
c. Having arranged requisitions in order of priority.
d. Receiving from co-worker.

1. The ultrasound B-scan equipment includes a contact scanner with use of an oil or gel to couple the transducer to the body.
   a. The scanning equipment may use a gray scale image displayed on a scan converter and recorded by photographing the gray scale monitor; gray scale images may be stored with the use of a "floppy disk." Earlier equipment may include time exposure of film and a conventional oscilloscope.
   b. Measurements of distance (calibrated to the time delay of the echoes) may be determined from a graticule superimposed on the image, or from electronic markers.
   c. The display image may be recorded with in-camera processed film, roll film

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

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List Elements

in a camera attached to oscilloscope, or floppy disk scanning device.

d. The scanning options may include programmed mechanical scanning at predetermined levels and cm intervals between scans, or may be done by manual movement of the transducer across the patient's body.

2. This task follows the general outline of Task Code 623. General initial steps include finding out the examination and diagnostic ultrasound mode called for, the patient involved, the physician in charge, details of the examination requested, any special considerations, and overall planning and preparation for the procedure:

   a. Performer reviews the examination options requested or considered to be standard for the examination to be done.
   b. Reviews which kidney is involved, whether both kidneys are to be scanned. Reviews suspected condition, the purpose of the examination, clinical background, prior scans, radiographs, and/or other diagnostic information.
   c. Considers the patient position, breath control, technical settings, sections (transverse and/or longitudinal, and/or special oblique planes), levels, cm intervals, and angulation required.

      i) Considers location of each kidney in relation to patient's bodily habitus.
      ii) Considers appropriate technical settings based on standard orders, request on requisition, or own experience with the type of tissue involved and as appropriate for the proximal organs and the condition to be detected.
      iii) Considers how to obtain the characteristic images that will produce diagnostic information.
      iv) Considers the particular type of artifacts or obstructing structures associated with the organ being examined, such as gas in the bowel, fluid in the stomach, overlying of one organ by another, reverberation artifacts reflecting tissue interfaces where none exist.

   d. Considers any collateral patient condition affecting handling of patient.
   e. If appropriate, discusses case with physician in charge to obtain further information, to clarify what is required, or to obtain signature.
   f. Prepares equipment and materials ahead as in Task Code 623 so as not to keep patient in examination room longer than necessary.

3. This task follows the patient preparation and examination steps of Task Code 623 in the following general areas:

   a. Observes sanitary precautions. Arranges to have patient brought to area and prepared for examination.
   b. Explains to patient what will happen.

      i) Reviews any breath control to be used, positions, how patient can cooperate.
      ii) Reassures patient and establishes a caring, professional relationship.
      iii) Applies mineral or paraffin oil or gel to the skin over the entire area to be scanned.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
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c. Positions patient and equipment. Adjusts technical settings for preliminary scanning.

d. Makes preliminary scans to locate the organ to be examined, evaluate the extent to which it is obscured, plan the best technique and the planes to scan in order to visualize the area of interest.

  i) Considers the diagnostic meaning of mass forms and organs, of cystic forms and fluid filled organs based on the location of the mass.

  ii) Considers possible artifacts. Notes areas of interest that should be investigated in detail.

  iii) May mark the lateral and medial edges of the kidney(s) at each transverse scan level by noting position of transducer when the leading edge of the scan display marks the border. Uses a wax or dye marker or metal markers. Connects marks when done to indicate the lateral and medial boundaries of organ for longitudinal scanning.

e. Treats scanning procedure as though the acoustic energy at diagnostic frequencies could be cumulatively harmful; therefore, avoids any unnecessary exposure of patient or self beyond what is needed to provide adequate information for diagnostic purposes.

f. Carries out ultrasound scanning as determined:

  i) Observes image on display and makes photographic record of each scan pass, so that a series is produced from the point where the structure being studied is first seen, as it develops, at its full cross-section dimensions, and as it disappears from the display.

List Elements

  ii) May repeat with longitudinal right angle or oblique sections.

  iii) During scanning performer interprets the structures being seen in order to modify the technical settings, angle and/or level of the scan to bring out and display relevant diagnostic information. Bears in mind the characteristic images produced by the relevant healthy or diseased structures and their appearance at given sensitivity or gain settings.

  iv) For observed masses, performer may examine the outlined mass at a variety of gain settings, using low gain to obtain information about the size and depth of the mass, and higher gain to differentiate a cystic from a tumor mass.

  v) Checks for echo-free zone and strong back-wall echoes as cystic pattern.

  vi) Checks for multiple echoes, weak back-wall echo at low and high gain, and incomplete filling in of echo-free zone at high gain as solid mass pattern.

  vii) Checks for strong back-wall echoes and scattered echoes within the echoe-free zone at high gain as necrosis or loculations (structurally complex mass with fluid) pattern.

  viii) Notes the contour of the mass; considers that smooth walls are often a characteristic of benign lesions and irregular walls more likely to indicate a malignancy.

  ix) During scanning may modify scanning planes and technical setting based on own judgment of what is being observed. Photographs displays as described.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
Code 626
This is page 4 of 5 for this task.

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g. Makes sure to properly process and identify each scan print or has this done; marks scans in sequence as well as with information on patient, date, level, section, right-left or longitudinal reference, and technical settings.
h. May record preliminary interpretation of scans.
i. As appropriate, responds to emergency situation; reassures patient.
j. May bring ultrasonograms to physician for immediate review and further orders.

   i) Reports emergency signs at once.
   ii) May present interpretation of scans orally.
   iii) May continue as ordered.

k. When examination is completed, removes oil or gel from patient's body. Assists patient to leave. Makes sure that patient is escorted or directed to next location, or properly discharged.
l. Records examination as appropriate.
m. Provides for clean-up of equipment, jacketing of scans, placement of all records for use as appropriate.

4. Unique features of this task are as follows:

a. Purpose of the examination may include differentiation of suspected renal tumors, polycystic disease, or solitary cystic renal disease, evaluation of size, position of kidney(s), assessment of size changes.
b. Prior considerations may include review of prior radiographs, such as intravenous urograms to localize a renal mass and determine the level of the mass for scanning.
c. May align patient in prone position on table. Starts with transverse or longitudinal scans depending on institutional practice.

List Elements

d. If performer will start with preliminary transverse scans, sweeps at the level of a mass to be investigated, or, for a screening examination, at about the level of the iliac crest. Moves transducer to other levels towards the head until the lower pole of the kidney of interest is identified. May locate the other kidney as well. Moves caudad if the kidney is encountered at the first sweep until the lowest point is encountered.

   i) May use transverse scans to mark lateral and medial borders of one or both kidneys, as described earlier, in preparation for longitudinal scans.
   ii) May enlist patient's help in holding breath.

e. Performer starts or continues with a set of longitudinal scans of one or both kidneys; examines both kidneys for complete standard examination.
f. Depending on performer's judgment of possible abnormalities in size, contour, or tissue type, makes additional scans at other levels, angles, or technical settings as appropriate to develop more precise diagnostic information.

   i) Bears in mind relation of other organs of similar appearance, such as the contour of the psoas major muscle, spleen. Notes interface of contours with other organs.
   ii) Attempts to move transducer sufficiently around patient to direct the acoustic beam at right angles to the kidney surface being studied.
   iii) Performer considers the diagnostic implications of forms in re-

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
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List Elements	List Elements
lation to patient's age. Considers conditions likely for infant, child, or adult as appropriate. g. Performer may carry out examination in similar manner to monitor renal transplants.	

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.

Code 627

This is page 1 of 4 for this task.

Performer's Name ______	Analyst(s) ______	Dept. ______
Job Title ______	Institution ______	Date ______

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Requisition reviewed; patient reassured, positioned; equipment set up; technique set; preliminary B-scan ultrasonograms made; final scanning planned; scans made; patient scanned in one position; fluid located; same area scanned with patient in shifted position; scans photographed, interpreted during scanning; additional scans made; processed prints identified; interpretation recorded or presented; examination records entered and placed for use.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Patient's ultrasound requisition sheet, ID card, ID bracelet, medical-technical history, prior scans, radiographs; phone; pen; forms; oil or gel; contact ultrasound scanner, ultrasonoscope control panel, viewing screen(s); camera, film, table, transducer; linens, towels; technique records; stretcher; wheelchair; view boxes

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Any patient; physician in charge of diagnostic ultrasound; supervisor; co-worker; nurse

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Making B-scan ultrasonograms of any patient's thoracic contents to study mediastinal masses, pulmonary emboli, pleural lesions, and/or pleural effusion by reviewing request; planning scan procedures; setting up equipment; reassuring and preparing pt.; making preliminary scans; searching for characteristic appearance of mass or fluid; planning scan levels, angles, technique, pt. positions; interpreting and adjusting to provide diagnostic information while making scans and photographic records; for pleural effusion, shifting pt. position while scanning same area; noting pattern change; recording or presenting preliminary interpretation; identifying scans; recording examination; placing ultrasonograms for use.

List Elements

Performer receives or obtains the ultrasound requisition form, patient's identification card, and any appropriate medical-technical history for any patient scheduled for medical diagnostic ultrasonography of the thoracic cavity in the B-scan mode to study mediastinal masses, pulmonary emboli, pleural lesions, and/or pleural effusion as a result of:

a. Regular assignment.
b. Checking assignment on schedule sheet.
c. Having arranged requisitions in order of priority.
d. Receiving from co-worker.

1. The ultrasound B-scan equipment includes a contact scanner with use of an oil or gel to couple the transducer to the body.

    a. The scanning equipment may use a gray scale image displayed on a scan converter and recorded by photographing the gray scale monitor; gray scale images may be stored with the use of a "floppy disk." Earlier equipment may include time exposure of film and a conventional oscilloscope.
    b. Measurements of distance (calibrated to the time delay of the echoes) may be determined from a graticule superimposed on the image, or from electronic markers.

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 2 of 4 for this task.

Code 627

Performer's Name____________ Analyst(s)____________ Dept.________
Job Title____________ Institution____________ Date________

List Elements

c. The display image may be recorded with in-camera processed film, roll film in camera attached to oscilloscope, or floppy disk storage device.
d. The scanning options may include programmed mechanical scanning at predetermined levels and cm intervals between scans, or may be done by manual movement of the transducer across the patient's body

2. This task follows the general outline of Task Code 623. General initial steps include finding out the examination and diagnostic ultrasound mode called for, the patient involved, the physician in charge, details of the examination requested, any special considerations, and overall planning and preparation for the procedure:

a. Performer reviews the examination options requested or considered to be standard for the examination to be done.
b. Reviews the area of interest, the suspected condition, the purpose of the examination, clinical background, prior scans, radiographs, and/or other diagnostic information.
c. Considers the patient position, breath control, technical settings, sections (transverse and/or longitudinal, and/or special oblique planes), levels, cm intervals and angulation required.

i) Reviews standard orders, request on requisition, or own experience with regard to technique appropriate for the organs to be examined and the condition to be detected.
ii) Considers how to obtain the characteristic images that will produce diagnostic information.
iii) Notes that mediastinal or pleura-based masses can be detected with ultrasound only if the mass is situated on the chest wall or in mediastinum in such a way that air does not block the penetration of the ultrasonic beam.
iv) Considers those conditions which are manifested by increased penetration of the ultrasonic beam, such as pulmonary embolus, pneumonia, atelectasis.
v) Considers any collateral patient condition affecting handling of patient.

d. If appropriate, discusses case with physician in charge to obtain further information or to clarify what is required, or to obtain signature.
e. Prepares equipment and materials ahead as in Task Code 623 so as not to keep patient in examination room longer than necessary.

3. This task follows the patient preparation and examination steps of Task Code 623 in the following general areas:

a. Observes sanitary precautions. Arranges to have patient brought to area and prepared for examination.
b. Explains to patient what will happen.

i) Reviews any breath control to be used, patient positions, how patient can cooperate.
ii) Reassures patient and establishes a caring, professional relationship.

c. Applies mineral or parrafin oil or gel to the skin over the entire area to be scanned.
d. Positions patient and equipment. Adjusts technical settings for preliminary scanning.
e. Makes preliminary scans to locate the area to be examined, evaluate the extent to which it is obscured,

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
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Code 627

Performer's Name______________ Analyst(s)______________ Dept.________
Job Title______________ Institution______________ Date________

List Elements

plan the best technique and the planes to scan in order to visualize the area of interest.

f. Evaluates scan information in light of condition being studied and characteristic appearance on displays. Considers possible artifacts. Notes areas of interest to be investigated in detail.

g. Carries out ultrasound scanning as determined:

  i) Observes image on display and makes photographic record of each scan pass, so that a series is produced from the point where the structure being studied is first seen, as it develops, at its full cross-section dimensions, and as it disappears from the display.

  ii) May repeat with longitudinal right angle or oblique scans.

  iii) During scanning performer interprets the structures being seen in order to modify the technical settings, angle,and/or level of the scan to bring out and display relevant diagnostic information. Bears in mind the characteristic images produced by the relevant healthy or diseased structures and their appearance at given sensitivy or gain settings.

h. Treats scanning procedure as though the acoustic energy at diagnostic frequencies could be cumulatively harmful; therefore,avoids any unnecessary exposure of patient or self beyond what is needed to provide adequate information for diagnostic purposes.

i. To distinguish free fluid from fluid contained within masses, within normal organs, or within loculations (small spaces or cavities), performer first finds the echo-free zone indicative of a fluid filled structure.

List Elements

  i) Then moves patient from that position to one in which the direction of gravity is shifted, while keeping transducer in the same location and direction on the patient's body.

  ii) If the echc-free zone decreases or disappears, concludes that there is free fluid present.

  iii) Performer may measure and mark the exact level of the fluid using the graticule or electronic distance scale.

j. For observed masses, performer may examine the outlined mass at a variety of gain settings, using low gain to obtain information about the size and depth of the mass, and higher gain to differentiate a cystic from a tumor mass.

  i) Checks for echo-free zone and strong back-wall echoes as cystic pattern.

  ii) Checks for multiple echoes, weak back-wall echo at low and high gain, and incomplete filling in of echo-free zone at high gain as solid mass pattern.

  iii) Checks for strong back-wall echoes and scattered echoes within the echo-free zone at high gain as necrosis or loculations (structurally complex mass with fluid) pattern.

  iv) Notes the contour of the mass; considers smooth walls as often a characteristic of benign lesions, irregular walls more likely to indicate malignancy.

k. Makes sure to properly process and identify each scan print,or has this done; marks scans in sequence as well as with information on patient, date, level, section, right-left or longitudinal reference, and technical settings.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
Code 627
This is page 4 of 4 for this task.

Performer's Name__________ Analyst(s)__________ Dept.__________
Job Title__________ Institution__________ Date__________

List Elements

l. May record preliminary interpretation of scans.
m. As appropriate, responds to emergency situation; reassures patient.
n. May bring ultrasonograms to physician for immediate review and further orders.

   i) Reports emergency signs at once.
   ii) May present interpretation of scans orally.
   iii) May continue as ordered.

o. When examination is completed, removes oil or gel from patient's body. Assists patient to leave. Makes sure that patient is escorted or directed to next location, or properly discharged.
p. Records examination as appropriate.
q. Provides for clean-up of equipment, jacketing of scans, placement of all records for use as appropriate.

4. Unique features of this task are as follows:

   a. Performer notes that the ultrasonic beam travels only a few centimeters in normal lung.

      i) Looks for signs of masses against pleural surface, chest wall or mediastinal surfaces.
      ii) If there is increased penetration of the beam, considers the presence of pulmonary embolus, pneumonia or atelectasis.

   b. To detect the presence of pleural effusion, places the patient in an erect position.

      i) Moves the transducer between the intercostal spaces until an echo-free zone is located on display. Checks for a strong back-wall echo.

List Elements

      ii) If no echo-free zone appears, and ultrasonic beam is almost totally reflected (strong echo complex) may conclude that no fluid is present.
      iii) If an echo-free zone is found, performer maintains the transducer in the same location and direction on the patient's body, and has patient assume a decubitus, supine, or prone position.
      iv) Checks whether the echo-free zone decreases or disappears. If so, may conclude that free pleural fluid has been found.
      v) If the echo-free zone pattern remains, may conclude that the fluid is loculated.
      vi) May measure and record fluid level and depth.

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
Code 628 This is page 1 of 4 for this task.

Performer's Name ____________ **Analyst(s)** ____________ **Dept.** ________
Job Title ____________ **Institution** ____________ **Date** ________

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Requisition reviewed; patient reassured, positioned; equipment set up; technique set; preliminary B-scan ultrasonograms made; final scanning planned; scans made, photographed, interpreted during scanning; processed prints identified; interpretation recorded or presented; examination records entered and placed for use.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Patient's ultrasound requisition sheet, ID card, ID bracelet, medical-technical history, prior scans, radioactive isotope scans, radiographs; phone; pen; forms; oil or gel; contact ultrasound scanner, ultrasonoscope control panel, viewing screen(s), camera, film, table, transducer; linens; view boxes; technique records; stretcher; wheelchair

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Any patient; physician in charge of diagnostic ultrasound; supervisor; co-worker; nurse

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Making B-scan ultrasonograms of superficial mass(es) of any patient by reviewing request; planning scan procedures; setting up equipment; reassuring and preparing patient; locating mass by palpation or visually; making preliminary scans; planning scan levels, angles, technique; interpreting and adjusting to provide diagnostic information while making scans and photographic records; recording or presenting preliminary interpretation; identifying scans; recording examination; placing ultrasonograms for use.

List Elements

Performer receives or obtains the ultrasound requisition form, patient's identification card, and any appropriate medical-technical history for any patient scheduled for medical diagnostic ultrasonography of superficial masses in the B-scan mode (such as for evaluation of breast lesion, thyroid mass, encephalocele, meningomyelocele, myelocele) as a result of:

a. Regular assignment.
b. Checking assignment on schedule sheet.
c. Having arranged requisitions in order of priority.
d. Receiving from co-worker.

1. The ultrasound B-scan equipment includes a contact scanner with use of an oil or gel to couple the transducer to the body.
    a. The scanning equipment may use a gray scale image displayed on a scan converter and recorded by photographing the gray scale monitor; gray scale images may be stored with the use of a "floppy disk." Earlier equipment may include time exposure of film and a conventional oscilloscope.
    b. Measurements of distance (calibrated to the time delay of the echoes) may be determined from a graticule superimposed on the image, or from electronic markers.

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 2 of 4 for this task.

Code 628

Performer's Name________________ **Analyst(s)**________________ **Dept.**________
Job Title________________ **Institution**________________ **Date**________

List Elements

c. The display image may be recorded with in-camera processed film, roll film in a camera attached to the oscilloscope, or floppy disk storage device.
d. The scanning options may include programmed mechanical scanning at predetermined levels and cm intervals between scans, or may be done by manual movement of the transducer across the patient's body.

2. This task follows the general outline of Task Code 623. General initial steps include finding out the examination and diagnostic ultrasound mode called for, the patient involved, the physician in charge, details of the examination requested, any special considerations, and overall planning and preparation for the procedure:

   a. Performer reviews the examination options requested or considered to be standard for the examination to be done.
   b. Reviews the location of the mass to be examined, the suspected condition, the purpose of the examination, clinical background, prior scans, radioisotope scans, radiographs, and/or other diagnostic information.
   c. Considers the patient position, technical settings, sections (transverse and/or longitudinal), levels, cm intervals, and angulation required.

      i) Reviews standard orders, request on requisition, or own experience with regard to technique appropriate for the mass to be examined and the condition to be detected.
      ii) Considers how to obtain the characteristic images that will produce diagnostic information.

List Elements

   d. Considers any collateral patient condition affecting handling of patient.
   e. If appropriate, discusses case with physician in charge to obtain further information or to clarify what is required, or to obtain signature.
   f. Prepares equipment and materials ahead as in Task Code 623 so as not to keep patient in examination room longer than necessary.

3. This task follows the patient preparation and examination steps of Task Code 623 in the following general areas:

   a. Observes sanitary precautions. Arranges to have patient brought to area and prepared for examination.
   b. Explains to patient what will happen:

      i) Reviews any breath control to be used, positions, how patient can cooperate.
      ii) Reassures patient and establishes a caring, professional relationship.
      iii) Locates the mass visually or by palpation.
      iv) Applies mineral or paraffin oil or gel to the skin over the entire area to be scanned.

   c. Positions patient and equipment. Adjusts technical settings for preliminary scanning.
   d. Places the transducer directly over the mass.
   e. Makes preliminary scans to select the best technique to use in order to differentiate the material of which the mass is composed. Adjusts technique as appropriate.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 3 of 4 for this task.

Code 628

Performer's Name ____________ **Analyst(s)** ____________ **Dept.** ________
Job Title ____________ **Institution** ____________ **Date** ________

List Elements

f. Carries out ultrasound scanning as determined:

- i) Observes image on display and makes photographic record of each scan pass, so that a series is produced from the point where the mass structure being studied is first seen, as it develops, at its full cross-section dimensions, and as it disappears from the display.
- ii) May repeat with longitudinal right angle sections.
- iii) During scanning performer interprets the structure being seen in order to modify the technical settings to bring out and display relevant diagnostic information. Bears in mind the characteristic images produced by the relevant healthy or diseased structures and their appearance at given sensitivity or gain settings.

g. Performer may examine the outlined mass at a variety of gain settings, using low gain to obtain information about the size and depth of the mass, and higher gain to differentiate a cystic from a tumor mass.

- i) Checks for echo-free zone and strong back-wall echoes as cystic pattern.
- ii) Checks for multiple echoes, weak back-wall echo at low and high gain, and incomplete filling in of echo-free zone at high gain as solid mass pattern.
- iii) Checks for strong back-wall echoes and scattered echoes within the echo-free zone at high gain as necrosis or loculations (structurally complex mass with fluid) pattern.
- iv) Notes the contour of the mass; considers that smooth walls are often a characteristic of benign lesions and irregular walls more likely to indicate a malignancy.
- v) During scanning may modify scanning planes and technical setting based on own judgment of what is being observed. Photographs displays as described.
- vi) Treats scanning procedure as though the acoustic energy at diagnostic frequencies could be cumulatively harmful; therefore, avoids any unnecessary exposure of patient or self beyond what is needed to provide adequate information for diagnostic purposes.

h. Makes sure to properly process and identify each scan print or has this done; marks scans in sequence as well as with information on patient, date, level, section, right-left or longitudinal reference, and technical settings.
i. May record preliminary interpretation of scans.
j. As appropriate, responds to emergency situation; reassures patient.
k. May bring ultrasonograms to physician for immediate review and further orders.

- i) Reports emergency signs at once.
- ii) May present interpretation of scans orally.
- iii) May continue as ordered.

l. When examination is completed, removes oil or gel from patient's body. Assists patient to leave. Makes sure that patient is escorted or directed to next location or properly discharged.
m. Records examination as appropriate.
n. Provides for clean-up of equipment, jacketing of scans, placement of all records for use as appropriate.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 4 of 4 for this task.

Code 628

Performer's Name__________ **Analyst(s)**__________ **Dept.**______
Job Title__________ **Institution**__________ **Date**______

List Elements	**List Elements**
4. Unique features of this task are as follows: a. May place lead markers on sites of previous biopsy scars for referencing. b. If a solid mass pattern appears, performer may note that in the breast or similar structures ultrasound alone cannot identify the type of solid mass. c. In neurological study such as masses of the meninges or spinal cord, attempts to determine whether mass contains only spinal fluid or spinal fluid plus spinal cord tissue.	

TASK IDENTIFICATION SUMMARY SHEET

Code 629

This is task ___ of ___ for this performer.
This is page 1 of 4 for this task.

Performer's Name ____________ **Analyst(s)** ____________ **Dept.** ________
Job Title ____________ **Institution** ____________ **Date** ________

1. **What is the output of this task? (Be sure this is broad enough to be repeatable.)**

Requisition reviewed; patient reassured, positioned; equipment set up; technique set; preliminary B-scan ultrasonograms made; final scanning planned; scans made, patient scanned in one position; fluid located; same area scanned with patient in shifted position; scans photographed, interpreted during scanning; processed prints identified; interpretation recorded or presented; examination records entered and placed for use.

2. **What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)**

Patient's ultrasound requisition sheet, ID card, ID bracelet, medical-technical history, prior scans, radiographs; phone; pen; forms; oil or gel; contact ultrasound scanner, ultrasonoscope control panel, viewing screen(s), camera, film, table, transducer; linens, table pads; technique records; stretcher; wheelchair; view boxes

3. **Is there a recipient, respondent or co-worker involved in the task?** Yes...(X) No...( )

4. **If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.**

Any patient; physician in charge of diagnostic ultrasound; supervisor; co-worker; nurse

5. **Name the task so that the answers to questions 1-4 are reflected. Underline essential words.**

Making B-scan ultrasonograms of any patient to differentiate free fluid from fixed fluid, such as in ascites by reviewing request; planning scan procedures; setting up equipment; reassuring and preparing patient; making preliminary scans; locating fluid-filled structure; planning scan levels, angles, technique, patient positions; interpreting and adjusting to provide diagnostic information while making scans and photographic records; shifting patient position while scanning same area; noting pattern change; recording or presenting preliminary interpretation; identifying scans; recording examination; placing ultrasonograms for use.

List Elements

Performer receives or obtains the ultrasound requisition form, patient's identification card, and any appropriate medical-technical history for any patient scheduled for medical diagnostic ultrasonography in the B-scan mode to differentiate free fluid from fixed (intralocular) fluid (such as in ascites) as a result of:

a. Regular assignment.
b. Checking assignment on schedule sheet.
c. Having arranged requisitions in order of priority.
d. Receiving from co-worker.

1. The ultrasound B-scan equipment includes a contact scanner with use of an oil or gel to couple the transducer to the body.

   a. The scanning equipment may use a gray scale image displayed on a scan converter and recorded by photographing the gray scale monitor; gray scale images may be stored with the use of a "floppy disk." Earlier equipment may include time exposure of film and a conventional oscilloscope.
   b. Measurements of distance (calibrated to the time delay of the echoes) and fluid depth may be determined from a graticule superimposed on the image, or from electronic markers.

OK-RP;RR;RR

6. **Check here if this is a master sheet..(X)**

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 2 of 4 for this task.

Code 629

Performer's Name__________ **Analyst(s)**__________ **Dept.**______
Job Title__________ **Institution**__________ **Date**______

List Elements

c. The display image may be recorded with in-camera processed film, roll film in camera attached to oscilloscope, or floppy disk storage device.
d. The scanning options may include programmed mechanical scanning at predetermined levels and cm intervals between scans, or may be done by manual movement of the transducer across the patient's body.

2. This task follows the general outline of Task Code 623. General initial steps include finding out the examination and diagnostic ultrasound mode called for, the patient involved, the physician in charge, details of the examination requested, any special considerations, and overall planning and preparation for the procedure:

   a. Performer reviews the examination options requested or considered to be standard for the examination to be done.
   b. Reviews the area of interest, the suspected condition, the purpose of the examination, clinical background, prior scans, radiographs, and/or other diagnostic information.
   c. Considers the patient position, breath control, technical settings, sections (transverse and/or longitudinal, and/or special oblique planes), levels, cm intervals and angulation required.

      i) Reviews standard orders, request on requisition, or own experience with regard to technique appropriate for the organs to be examined and the condition to be detected.
      ii) Considers how to obtain the characteristic images that will produce diagnostic information.
      iii) Considers the particular type of artifacts or obstructing structures associated with the organ being examined, such as gas in the bowel, fluid in the stomach or bladder, overlying of one organ by another, reverberation artifacts reflecting tissue interfaces where none exist.
      iv) Considers any collateral patient condition affecting handling of patient.

   d. If appropriate, discusses case with physician in charge to obtain further information or to clarify what is required, or to obtain signature.
   e. Prepares equipment and materials ahead as in Task Code 623 so as not to keep patient in examination room longer than necessary.

3. This task follows the patient preparation and examination steps of Task Code 623 in the following general areas:

   a. Observes sanitary precautions. Arranges to have patient brought to area and prepared for examination.
   b. Explains to patient what will happen:

      i) Reviews any breath control to be used, patient positions, how patient can cooperate.
      ii) Reassures patient and establishes a caring, professional relationship.

   c. Applies mineral or paraffin oil or gel to the skin over the entire area to be scanned.
   d. Positions patient and equipment. Adjusts technical settings for preliminary scanning.
   e. Makes preliminary scans to locate the area to be examined, evalute the extent to which it is obscured, plan the best technique

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 3 of 4 for this task.

Code 629

Performer's Name ____________ **Analyst(s)** ____________ **Dept.** ________
Job Title ____________ **Institution** ____________ **Date** ________

List Elements

and the planes to scan in order to visualize the area of interest.

f. Evaluates scan information in light of condition being studied and characteristic appearance on displays. Considers possible artifacts. Notes areas of interest to be investigated in detail.

g. Carries out ultrasound scanning as determined:

  i) Observes image on display and makes photographic record of each scan pass, so that a series is produced from the point where the structure being studied is first seen, as it develops, at its full cross-section dimensions, and as it disappears from the display.

  ii) Repeats with longitudinal right angle or oblique scans.

  iii) During scanning performer interprets the structures being seen in order to modify the technical settings, angle and/or level of the scan to bring out and display relevant diagnostic information. Bears in mind the characteristic images produced by the relevant healthy or diseased structures and their appearance at given sensitivity or gain settings.

h. Treats scanning procedure as though the acoustic energy at diagnostic frequencies could be cumulatively harmful; therefore, avoids any unnecessary exposure of patient or self beyond what is needed to provide adequate information for diagnostic purposes.

i. To distinguish free fluid from fluid contained within masses, within normal organs, or within loculations, performer first finds the echo-free zone indicative of a fluid-filled structure.

List Elements

  i) Places patient in erect, supine, lateral decubitus, or prone (hand-knee) position depending on area of interest, so that any free fluid will accumulate in the most dependent cavity of the area of interest.

  ii) Moves the transducer over the area until an echo-free zone is located. Checks for echo-free zone and strong back-wall echoes.

  iii) If no echo-free zone appears, may conclude that no fluid is present.

  iv) If an echo-free zone is found, performer maintains the transducer in the same location and direction on the patient's body and has patient shift position (such as from erect to decubitus, supine to decubitus, from lateral decubitus to supine, or from prone (hand-knee) to supine).

  v) Checks for a change in the echo-free zone pattern. If echo-free zone decreases or disappears, may conclude that free fluid has been found. If echo-free zone pattern remains, may conclude that fluid is loculated.

  vi) Performer may mark the fluid level and measure the fluid depth by using the distance scale (graticule or electronic marker). Records.

j. Makes sure to properly process and identify each scan print or has this done; marks scans in sequence as well as with information on patient, date, level, section, right-left or longitudinal reference, and technical settings.

k. May record preliminary interpretation of scans.

l. As appropriate, responds to emergency situation; reassures patient.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 4 of 4 for this task.

Code 629

Performer's Name__________ **Analyst(s)**__________ **Dept.**______
Job Title__________ **Institution**__________ **Date**______

List Elements	**List Elements**
m. May bring ultrasonograms to physician for immediate review and further orders. i) Reports emergency signs at once. ii) May present interpretation of scans orally. iii) May continue as ordered. n. When examination is completed, removes oil or gel from patient's body. Assists patient to leave. Makes sure that patient is escorted or directed to next location or properly discharged. o. Records examination as appropriate. p. Provides for clean-up of equipment, jacketing of scans, placement of all records for use as appropriate.	

TASK DESCRIPTION SHEET

Task Code No. 630

This is page 1 of 8 for this task.

1. **What is the output of this task? (Be sure this is broad enough to be repeatable.)**

Requisition reviewed; patient reassured, positioned; equipment set up; technique set; A-mode echoencephalograms of right and left side brain pattern separately displayed for given levels of interest, photographed on single film frames; transmission sounding made and filmed; prints identified; preliminary interpretation made, recorded or presented; examination recorded; echoencephalograms placed for use or brought to physician.

2. **What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)**

Patient's ultrasound requisition sheet, ID card, ID bracelet; medical-technical history, prior echoencephalograms, radioisotope scans, radiographs; phone; pen; forms; oil or gel; contact A-mode ultrasonoscope,control panel, viewing screen(s), camera, film, chair with head support or table, transducer(s); clean linens, pads, table covering;technique records; stretcher;wheelchair;view boxes;calipers;wax marker

3. **Is there a recipient, respondent or co-worker involved in the task?** Yes...(X) No...( )

4. **If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.**

Any patient; physician in charge of diagnostic ultrasound; supervisor; co-worker; nurse

5. **Name the task so that the answers to questions 1-4 are reflected. Underline essential words.**

Making A-mode echoencephalograms of any patient by planning procedure; setting up equipment; reassuring and preparing patient; laying out reference points for echoencephalograms; imaging first side midline pattern and photographing; imaging second side midline pattern and photographing; making transmission sounding to find acoustic midpoint; repeating for other levels as ordered or determined; making, recording or presenting preliminary interpretation; identifying echoencephalogram prints; recording examination; placing ultrasonograms for use or bringinto to physician.

List Elements Fully

Performer receives or obtains the ultrasound requisition form, patient's identification card, and any appropriate medical-technical history for a patient scheduled for echoencephalography (medical diagnostic ultrasonography in A-mode, in which reflected acoustic energy is used for medical imaging of the structures of the brain, with the display being spikes, whose heights are proportional to the reflected sound, and whose horizontal axis represents time translated as a measurement of the depth of the reflecting interface) as a result of:

a. Regular assignment.
b. Checking assignment on schedule sheet.
c. Having arranged requisitions in order of priority.
d. Receiving from co-worker.

1. Performer reads the requisition sheet to determine the examination called for, the patient involved, any special considerations, to plan for the procedure, and to check the completeness of the information provided:

    a. Performer reads patient's name, identification number, sex, age, and weight. Notes whether patient is in-patient, out-patient, accident,or emergency patient.
    b. Notes the name of the physician in charge; may note the name of the re-

OK-RP;RR;RR

6. **Check here if this is a master sheet..(X)**

TASK DESCRIPTION SHEET (continued)

Task Code No. 630

This is page 2 of 8 for this task.

List Elements Fully

ferring physician; determines to whom the echoencephalograms are to be delivered for interpretation.

c. Performer reviews the examination requested and the purpose, such as localization and measurement of the midline structures of the brain, and any displacement resulting from trauma, space occupying lesions, or cerebrovascular diseases.

  i) Notes whether examination is being used as a preliminary emergency study to give immediate information to detect midline shifts due to trauma, to indicate the side of interest in connection with emergency surgery or cerebral arteriography.
  ii) Notes whether examination is one in a series taken over time to follow the position of midline structures over the course of radiation therapy, to aid in differentiation of cerebrovascular accident from tumor symptoms, or to detect hemorrhage.

d. Performer may review any relevant diagnostic information so as to anticipate what to watch for in the ultrasonographic imaging.

  i) May receive or obtain and review prior echoencephalograms if the procedure is one of a series; may review prior radiographs or radioisotope scans.
  ii) May review clinical information that will affect patient positioning or handling, such as presence of accident injuries, unhealed or suspected fracture, behavioral disorder, incoherence, tremors, heart disease, communicable or infectious condition.
  iii) Notes whether a special condition exists such as surgical removal of one side of skull.

List Elements Fully

e. If available, performer reviews the technique to be used for the ultrasound examination. Consults record of prior echoencephalogram and/or standardized technique charts if available, and/or specific orders on requisition sheet.

  i) Notes the particular machine to be used.
  ii) Notes whether study will be done with one transducer acting as transmitter and receiver or with two transducers, one transmitting and one receiving.
  iii) Notes the number of points at which to make ultrasonograms. Checks locations at which to place transducer with respect to anatomical reference lines on the skull.
  iv) Notes whether patient is to be seated or supine for the examination.
  v) Notes technical settings such as gain, intensity, use of enlarged or reduced scale (if available).

f. Performer notes any special information that will affect patient positioning, technique, or handling of the patient.

  i) Notes how patient will arrive for examination (whether in wheelchair, on stretcher, accompanied by staff member, whether patient will be coherent, sedated).
  ii) With patients with accident injuries or unhealed fractures, performer may make sure that a physician is available to position the patient; checks whether movement of head is contraindicated.

TASK DESCRIPTION SHEET (continued)

Task Code No. 630

This is page 3 of 8 for this task.

List Elements Fully

g. If the performer determines that the request is not properly authorized, is incomplete, that sufficient information is lacking for performer to proceed properly, performer notifies supervisor, physician in charge, or other designated staff person, depending on institutional procedures. Explains the problem if appropriate, and proceeds after obtaining needed information, signature, or orders.

h. If referring physician has requested that ultrasonograms already on file be sent with current scans, and if not already with patient's jacketed material, performer arranges to have prior scans delivered.

i. Performer may prepare appropriate charts and papers (for use in measurement or interpretation) for delivery to physician in charge, or has this done.

3. When performer is clear about what will be involved in examination, he or she goes to appropriate room for the equipment required, or notes room assigned on requisition sheet. Prepares ahead so as not to keep patient in examination room longer than necessary. Washes hands as appropriate.

   a. If appropriate, checks that the type of transducer appropriate to the examination and mode to be used is attached to the ultrasound scanner. May detach and change transducer. May plug in a second transducer. If so, makes sure that electric power is turned off before detaching or attaching the transducer(s).

   b. Checks for clean linens mattress, pads, pillows, and/or blankets for comfort of patient.

   c. May prepare identification markers as appropriate to be included on films.

List Elements Fully

   d. Makes sure that the equipment is warmed up and ready for use, and that controls are unlocked.

   e. Notes whether viewing equipment uses visual electronic markers to indicate the time-distance scale, and/or a graticule which is superimposed on the image (a scale on transparent material in the focal plane of the optical instrument).

   f. Checks that equipment has been calibrated as appropriate for accurate time-distance measurements, or has this done. If appropriate, records the appropriate correction for the calibration figure for use in making measurements.

   g. Makes sure that there is no equipment present that would create an explosive atmosphere.

   h. Notes whether display image will be recorded with in-camera processed film such as a Polaroid camera and film, or may use 35mm film in a camera attached to the oscilloscope.

   i. If not already done, performer checks whether camera unit is loaded with adequate film for the procedure. May check film supply indicator or opens back of camera and inspects. If appropriate, loads and sets up camera or has this done as in Task Code 623.

   j. Sets controls as selected for the examination, patient's skull size, and the equipment to be used.

      i) Sets camera controls as appropriate.
      ii) Sets for A-mode operation as appropriate.
      iii) May select a control to display the gain curve if an option.
      iv) Selects and sets gain control as appropriate.
      v) Sets intensity control.
      vi) Adjusts astigmatism, focus and/or scale illumination as appropriate.

TASK DESCRIPTION SHEET (continued)

Task Code No. 630

This is page 4 of 8 for this task.

List Elements Fully

- vii) Sets up so that the horizontal baseline will start at the left edge of the graticule; sets vertical controls to provide for traces from both sides of the skull to appear in close alignment (with the second side inverted and photographed under the first side).
- viii) Selects and sets the appropriate scale to be used for the imaging.
- ix) Checks that all controls are operative.
- x) If performer decides that any of the equipment is not functioning properly, or is not ready for use, informs appropriate staff member and proceeds as ordered, or notifies service organization.

k. Washes hands as appropriate.

4. Performer has the patient brought from the holding area and prepared for the examination (if not already done), or decides to do personally.

a. Depending on institutional arrangements, performer may decide to assist in bringing patient to examination room (on stretcher if patient is very ill, injured, or has already been sedated, or is in wheelchair). May bring machine to patient's bedside and set it up there.

b. Greets coherent patient and any accompanying staff person and introduces self. Checks patient's identity against the requisition sheet. With in-patient, checks hospital identification bracelet or other identifier. Checks with any accompanying staff member on any special precautions necessary during procedure.

c. If patient is an accident victim or emergency patient and is on a stretcher or bed, performer plans to make ultrasonograms without moving patient and without rotating head or torso.

List Elements Fully

If any manipulation of patient's head is required, performer has physician carry this out.

d. May have patient assisted to examination table or to examination chair with head rest, or decides to do personally, depending on position in which patient will be examined and patient's condition.

- i) Makes sure that no equipment is in the way that may be collided with by patient.
- ii) If patient is on stretcher or in wheelchair, places into position and locks. May provide head support for patient in wheelchair.
- iii) May have nurse carefully lift infant and then place on table, or lifts infant carefully, supporting infant's head, and places in position with head supported.
- iv) May check that hair pins, spectacles, and any jewelry at head or neck have been removed.
- v) Makes sure patient is being attended and there is no danger patient will fall. If patient has respiration, cardiac, infusion equipment or urinary catheter attached, makes sure that equipment is being monitored and is not dislodged. May check that patient is being kept warm. May support bony prominences to provide comfort.

e. Explains to coherent patient what will be involved in the procedure:

- i) May explain what ultrasound is in contrast to other forms of imaging, that it is painless. May demonstrate how the equipment will be functioning (without exposing patient to actual ultrasound waves at this time).

TASK DESCRIPTION SHEET (continued)

Task Code No. 630

This is page 5 of 8 for this task.

List Elements Fully

ii) Describes what will happen and the need to use a lubricating coupling agent.

iii) Explains what cooperation will be asked of patient. Explains the need to have patient relax temporal muscles when requested.

iv) Performer answers patient's nonmedical questions honestly; attempts to reassure patient and develop confidence. Treats patient with dignity and concern regardless of patient's behavior or age. Remains aware that patient may be frightened, uncomfortable and/or in pain. Performer explains, when asked medical questions, that it is not appropriate for technologist to answer these; encourages patient to speak to physician.

f. Performer may mark or define anatomic reference lines and points on the patient's skull on both sides and measure as appropriate so as to select three or more standard reference points for placement of the transducer(s).

i) May use wax marker. Marks out points as selected slightly above and anterior to the superior root of the ear on the first side to be examined, and then the equivalent point(s) on the other side.

ii) Marks additional points as predetermined for the examinations on both sides.

iii) May use calipers to measure the bitemporal diameter(s) at each level to be examined. Records. Divides in half to calculate theoretical midline. Records.

g. Performer applies paraffin or mineral oil or gel liberally to the areas where the transducer will be applied so as to avoid having any trapped air around patient's hair.

5. Performer makes the echoencephalograms as follows:

a. Places flat surface of transducer on the first (right) side to be examined at the first point marked or determined. (With two transducers places one on each temple in equivalent positions as appropriate.)

b. Activates equipment and observes the trace on the oscilloscope screen.

i) Gently and firmly rocks transducer until a strong midline pattern recognized by performer appears. Checks for echoes from the near side of the skull, midline, and far side.

ii) Checks for near-side echo arising at the surface of transducer (crystal artifact), inner tables and meninges, midline structures, far side inner and outer tables of skull, and the far-side skin-air interface.

iii) If multiple echoes appear, may identify far-side skin-air echo by applying finger pressure over the scalp opposite transducer. Checks for the disappearance of artifact echo and true echo at the point where skin is compressed (with observed movement due to compression).

iv) May check for midline echo by looking for a strong spike pattern, a single M-shaped echo, or two spikes no more than 6mm apart.

v) May use control option (if available) to suppress the strong signals close to the transducer.

TASK DESCRIPTION SHEET (continued)

Task Code No. 630

This is page 6 of 8 for this task.

List Elements Fully

vi) May expand or compress the scale of the display if option exists with equipment.

vii) Evaluates the display and makes readjustments in the gain setting if so decided. May adjust brightness, focus or resolution.

c. When the first-side echo pattern is optimally displayed, performer photographs the trace.

d. Operates control to invert the image for the opposite (left) side pattern. Places the search transducer on appropriate point of the left side of head and attempts to duplicate the echo pattern previously recorded from the right side. When satisfied that beam-path and echo pattern have been duplicated, photographs trace (so that each trace is photographed individually on a single frame of film).

i) If equipment has option, repositions baseline at top of screen and performs a transmission sounding to determine acoustic midpoint of patient's head. If a single, well defined spike is obtained along same beampath as for previous soundings, photographs trace.

ii) If equipment has option, repositions baseline at bottom of screen. Operates control to display comb markers or other scale device and photographs trace.

e. For patients with one side of the skull removed, starts with the intact side of the skull. Notes the position of the skin-air interface. Positions on opposite side. Applies sufficient pressure to the skin on far side to permit alignment of the two images.

List Elements Fully

f. Performer makes a preliminary determination of whether echoencephalograms of good diagnostic quality have been obtained and whether a midline shift is apparent. May compare with prior echoencephalograms if available.

i) If the pattern obtained does not seem appropriate or characteristic, performer may decide that the patient's skull and brain proportions and topography are not typical. May decide to select other points for tracing. If so, repeats as appropriate and records the level and point at which the tracings were made.

ii) If a midline shift appears excessive, performer may consider that echoes other than from midline structures have been misinterpreted, such as wall of lateral ventricle. Performer may repeat examination and search again for the midline echo.

g. Repeats examination for the other points on the skull as described. Adjusts technique as appropriate.

i) Performer tries as much as possible to avoid exposing the patient to more ultrasonic energy than is warranted to provide diagnostic information. Until a final determination is made about the safety of ultrasonic frequencies in the diagnostic range, performer proceeds as though the exposure could have a negative, cumulative effect. Is careful in exposing both self and the patient without causing alarm in the patient.

ii) Before each new set of tracings uses controls to erase the image being displayed.

TASK DESCRIPTION SHEET (continued)

Task Code No. 630

This is page 7 of 8 for this task.

List Elements Fully

iii) While viewing on screen, performer judges whether the image being produced provides adequate information on the basis of which physician can come to diagnostic conclusions.

iv) When performer judges that an image is of diagnostic quality, performer operates camera exposure control to take picture of display and have processed in-camera, or has co-worker operate camera and processing.

v) Unless identification information is photographed with display, records the patient's name, identification number, the date, the right-left reference direction, the level; may number the scans in sequence; may record technical settings; may have this done by co-worker.

6. When performer judges that all relevant echoencephalogram records have been made, performer may record his or her preliminary interpretation of the images.

   a. If performer judges that an emergency condition may be present, notifies physician in charge at once.
   b. For emergency or pre-surgical patient may take echoencephalograms to attending physician at once.
   c. As appropriate, may present and/or discuss the results.Repeats or makes additional echoencephalograms as ordered. Proceeds as described above.
   d. Throughout procedure performer observes patient for any signs of emergency and/or to prevent or respond to an accident. Reports at once to appropriate staff member. Assists patient or makes sure patient is attended.

List Elements Fully

7. When performer determines that the examination has been completed, carries out termination steps for examination:

   a. Performer gently removes gel or mineral oil from patient or has this done.
   b. Performer may assist patient from table or chair. Makes sure patient is reminded of any footrest in stepping off table. Makes sure that none of the equipment is projecting over the patient before allowing patient to rise from table.
   c. Performer may have patient transported to next assigned location, or to area to put on street clothes, or decides to do personally, as appropriate. If appropriate, makes sure that patient is in the care of staff person who will transport to appropriate next location, or, if out-patient, arranges to discharge or send patient home, with escort if appropriate.
   d. Performer may have room and equipment cleaned; may decide to do personally. Has any other appropriate clean-up procedures followed to avoid infection or contamination, or decides to do personally, depending on institutional procedures.
   e. Performer records the examination according to institutional procedures. May include date, machine used, examination type, number of echoencephalograms recorded, levels, technical settings. May record any problem with equipment, any special care provided patient. Signs requisition sheet.
   f. May present requisition form to physician for comments and signature.

TASK DESCRIPTION SHEET (continued)

Task Code No. 630

This is page 8 of 8 for this task.

List Elements Fully	List Elements Fully
g. Performer may decide to jacket echoencephalograms, requisition sheets, preliminary notes, own interpretations, and related materials. May have information recorded in log book. May decide to do personally or has this done, depending on institutional procedures. Makes sure that identification information and the reference area are marked on each ultrasonogram and that the prints are in proper sequence. h. May indicate to appropriate staff person when the performer is ready to proceed with next examination.	

TASK CODE	EXTENDED TASK NAME
631	*Making A-mode and B-mode scan ultrasonograms of a fetal skull in utero* by planning procedure; setting up equipment; reassuring and preparing pregnant patient; doing preliminary scan over maternal abdomen to locate fetal skull; aligning transducer so that two sides of skull are at right angles to sound beam by checking for A-mode echoes of equal height; making ultrasonograms of fetal skull midline as appropriate; making B-scan ultrasonograms at same levels as A-mode ultrasonograms, where oval shape and greatest diameter is obtained; photographing displays; recording measurements; recording or presenting preliminary interpretation; identifying ultrasonograms; recording examination; placing ultrasonograms for use or bringing to physician.
632	*Loading camera for photography of oscilloscope display; making exposures on orders; recording patient identification, date, series number, level and directional reference* by checking camera; loading if needed or when empty with Polaroid or roll film; making exposure when ordered; removing print after in-camera processing or placing roll film for processing; marking prints with appropriate patient, sequence, and technique information; placing for fixing or for use.
633	*Reassuring any patient and/or accompanying adult about diagnostic ultrasound procedures and/or explaining prior fluid intake if appropriate*, by being sympathetic, interested, professional, and calming patient or adult; explaining safety of procedures, what will happen; answering non-medical questions about procedures; explaining fluid intake necessary prior to examination if appropriate.

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
This is page 1 of 3 for this task.

Code 634

Performer's Name___________ **Analyst(s)**___________ **Dept.**_______
Job Title___________ **Institution**___________ **Date**_______

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Requisition reviewed; patient reassured, positioned; equipment set up; technique set; longitudinal and transverse B-scan ultrasonograms made; A-mode levels selected; A-mode ultrasonograms made in AP and lateral directions; ultrasound displays photographed, interpreted during procedures; additional ultrasonograms made; processed prints identified; interpretation recorded or presented; examination records entered and placed for use.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Patient's ultrasound requisition sheet, ID card, ID bracelet, medical-technical history, prior ultrasonograms, radiographs; phone; pen; forms; oil or gel; contact ultrasound B-scanner and A-mode ultrasonoscope, control panel, viewing screen(s); camera, film, table, transducer; linens, pads, table covering; technique records; stretcher; wheelchair; view boxes; wax or dye marker or metal markers

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Any patient; physician in charge of diagnostic ultrasound; supervisor; co-worker; nurse

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Making B-mode scan and A-mode ultrasonograms of any patient's abdominal aorta by reviewing request; planning procedures; setting up equipment; reassuring and preparing patient; making preliminary scans; making longitudinal and transverse B-scans; determining levels for A-mode ultrasonograms; making A-mode ultrasonograms in AP and lateral directions at levels decided; interpreting and adjusting to provide diagnostic information while making ultrasonograms and photographic records; recording or presenting preliminary interpretation; identifying ultrasonograms; recording examination; placing ultrasonograms for use.

List Elements

Performer receives or obtains the ultrasound requisition form, patient's identification card, and any appropriate medical-technical history for a patient scheduled for a diagnostic ultrasound examination of the abdominal aorta in the B-scan and/or in the A-scan mode as a result of:

a. Regular assignment.
b. Checking assignment on schedule sheet.
c. Having arranged requisitions in order of priority.
d. Receiving from co-worker.

1. This task follows the general outline of Task Codes 623, 625, and 630.
   a. General initial steps include finding out the examination and diagnostic ultrasound mode called for, the purpose, the patient involved, the physician in charge, technical details of the examination requested, any special considerations, and overall planning and preparation for the procedure.
   b. Prepares equipment and materials ahead as in Task Codes 623 and 630 so as not to keep patient in examination room longer than necessary.
   c. Follows the general patient preparation and examination steps of Task Codes 623 and 630.

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
Code 634 This is page 2 of 3 for this task.

Performer's Name__________ Analyst(s)__________ Dept.__________
Job Title__________ Institution__________ Date__________

List Elements

d. Follows the general record making, emergency response, and recording or reporting of preliminary findings to appropriate physician as in Task Codes 623 and 630.
e. Terminates task, cares for patient, records examination, arranges to transport patient or have this done, provides for clean-up of room, and places records for use as in Task Codes 623 and 630.

2. Unique features of this task are as follows:

a. Reviews purpose of examination, such as to measure the diameter of the aortic lumen, to estimate aortic wall thickness, for use as a screening procedure to find evidence of abnormality, for detection of abdominal aortic aneurysm, as part of a series of examinations to follow progressive increases in aneurysm size or response to therapy, or other purpose.
b. Notes whether A-mode or B-mode scan will be used first.
c. Has patient assume a supine position.
d. If there is known or suspected aneurysm, is careful to be very gentle in moving transducer over the area.
e. For B-mode scan, performer first moves the transducer in a longitudinal direction from the xiphoid process to the umbilicus.

    i) Makes several parallel scans at the midline and as appropriate to define the course of the aorta (to left of midline usually). Makes photographs of scans as deemed appropriate.
    ii) Uses low gain settings to obtain information on the size and depth of structures, and high gain to investigate the type of tissue involved.
    iii) May mark reference points while carrying out longitudinal scanning (using wax or dye marker or metal markers) in preparation for transverse scans and A-mode readings.
    iv) Performer carries out transverse B-mode scanning at the levels determined during the longitudinal scanning. Adjusts gain settings as appropriate. Makes photographic records to provide information about the contour of the vessel.
    v) May make transverse scans at predetermined intervals from the xiphoid process, moving caudally until the bifurcation of the aorta is reached. Marks levels in preparation for A-mode records.
    vi) May select levels for A-mode ultrasonograms such as widest point, levels showing stenosis, evidence of aneurysm. Marks levels.

f. Depending on institutional procedures, uses B- or A-mode to make measurements of the aortic lumen and walls or any aneurysm in AP and lateral directions. Uses depth marker or graticule as appropriate. Records.
g. For A-mode examination performer plans AP and lateral ultrasound readings.

    i) Places transducer in AP and then in lateral position at the levels at which the B-mode transverse scans were taken (as marked).
    ii) Selects appropriate gain settings.
    iii) Checks for echo-free appearance of blood filled tumor and echoes from the aortic walls. Checks for a slight expansile motion of the walls. Takes account of patient's age, with less motion expected in older more arteriosclerotic vessels. Makes photographic records.

f. May check for the site of an occlu-

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 3 of 3 for this task.

Code 634

Performer's Name________ Analyst(s)________ Dept.________
Job Title________ Institution________ Date________

List Elements	List Elements
sion by observing the motion of the walls and determining the level at which the motion ceases. May repeat B-scan study at this point. i. May decide to document the pulsation of the vessel by use of a time-motion (T/M) mode if available. (See Task 635.) j. Treats scanning procedure as though the acoustic energy at diagnostic frequencies could be cumulatively harmful; therefore, avoids any unnecessary exposure of patient or self beyond what is needed to provide adequate information for diagnostic purposes.	

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
Code 635 This is page 1 of 4 for this task.

Performer's Name __________ **Analyst(s)** __________ **Dept.** ______
Job Title __________ **Institution** __________ **Date** ______

1. **What is the output of this task? (Be sure this is broad enough to be repeatable.)**

Requisition reviewed; patient reassured, positioned; equipment set up; technique set; preliminary M-mode imaging done; transducer position selected; technique set; M-mode echocardiograms and ECG recorded; motion of mitral valve measured; pericardial fluid detected; tamponade noted, reported; aortic arch, right pulmonary artery, left atrium examined, measured; processed prints identified; interpretation recorded or presented; examination records entered and placed for use; emergency reported.

2. **What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)**

Patient's ultrasound requisition sheet, ID card, ID bracelet, medical-technical history, prior echocardiograms, radiographs; phone; pen; forms; oil or gel; contact ultrasound scanner, ultrasonoscope control panel, viewing screen(s); camera, film, strip chart record device, table, transducer; linens, pads, table cover; technique records; stretcher; wheelchair; view boxes; ECG cable, connector

3. **Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )**

4. **If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.**

Any patient; physician in charge of diagnostic ultrasound; supervisor; co-worker; nurse

5. **Name the task so that the answers to questions 1-4 are reflected. Underline essential words.**

Making M-mode echocardiograms of the heart and pericardium of any patient,by reviewing request;planning procedures;setting up equipment;reassuring and preparing pt.;placing transducer;making preliminary echocardiograms;evaluating for presence of pericardial effusion;studying,measuring mitral valve amplitudes; evaluating for emergency such as tamponade;studying aortic arch,right pulmonary artery,left atrium;interpreting and adjusting to provide diagnostic information while making M-mode ultrasonograms,ECG,strip and photographic records;measuring lumens,diameters of vessels,motion;recording or presenting preliminary interpretation;identifying ultrasonograms;recording examination;placing ultrasonograms for use.

List Elements

Performer receives or obtains the ultrasound requisition form, patient's identification card, and any appropriate medical-technical history for a patient scheduled for echocardiography (medical diagnostic ultrasonography of the heart and pericardium in M-mode (AB mode or TM mode), in which the location of each echo is plotted as a function of time, and the brightness of the displayed image points is determined by the strength of the echo, with a moving structure shown as a moving echo, and velocity determined by the rate of the motion relative to the time axis, as a result of:

a. Regular assignment.
b. Checking assignment on schedule sheet.
c. Having arranged requisitions in order of priority.
d. Receiving from co-worker.

1. This task follows the general outline of Task Codes 623, 627, and 630 as follows:

   a. The initial steps include finding out the examination and diagnostic ultrasound mode called for, the purpose, the patient involved, the physician in charge, technical details of the examination requested, any special considerations, and overall planning and preparation for the procedure.

OK-RP;RR;RR

6. **Check here if this is a master sheet..(X)**

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
Code 635 This is page 2 of 4 for this task.

Performer's Name___________ **Analyst(s)**___________ **Dept.**________
Job Title___________ **Institution**___________ **Date**________

List Elements

b. Prepares equipment and materials ahead as in Task Codes 623 and 630 so as not to keep patient in examination room longer than necessary.

c. Follows the general patient preparation and examination steps of Task Codes 623 and 630.

d. Carries out photographic record making, response to emergency, and recording or reporting of preliminary findings to appropriate physician as in Task Codes 623 and 630.

e. Terminates task; cares for patient; records examination; arranges to transport patient or have this done; provides for clean-up of room; and places records for use as in Task Codes 623 and 630.

2. Unique features of this task are as follows:

a. In reviewing purpose of examination notes whether performer is to visualize and/or measure various structures such as parts of the heart and pericardium, is to detect conditions such as pericardial effusion, is to investigate suspected tamponade, is to study mitral valve motion, the aortic arch, right pulmonary artery, left atrium, to continue with series studies to measure the response to medical treatment, or carry out similar study.

i) If a cardiac emergency is present, works as rapidly as possible and makes sure staff is available to provide emergency life support.
ii) For series study checks prior technique used and plans to duplicate it.
iii) Notes whether the M-mode display will be recorded using in-camera processed film, and/or continuous strip chart recording.
iv) Notes whether an ECG will be recorded on the echocardiogram.

List Elements

b. In setting up equipment for M-mode, selects features appropriate for time-motion display:

i) Sets up and attaches camera if appropriate or has this done.
ii) May set the rate of the M-mode sweep (rate per second at which one cycle is completed).
iii) Selects display scale if there is option. Sets scale (graticule) illumination as appropriate.
iv) Selects control to set ultrasonoscope to M-mode position.
v) Selects gain setting appropriate for examination and patient's size.
vi) Sets intensity, focus,and astigmatism as appropriate.
vii) Uses horizontal and vertical position controls to center image as appropriate.
viii) Selects controls if available to increase the gain of signals distant to the transducer.
ix) Sets up equipment as appropriate to provide for simultaneous recording of ECG on strip chart and/or film. Connects cable; sets ECG gain as appropriate.
x) If available, sets up M-mode controls so that filming can be made without delay by synchronizing the camera with the oscilloscope trace.
xi) May plan to place the transducer in one fixed position for each echocardiogram (with change in direction for strip-chart recording), or may plan more than one position.

c. In preparing and positiong patient, takes account of possible emergency heart conditions and treats patient accordingly. If appropriate, has ECG leads placed in position on patient or decides to do personally.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
Code 635 This is page 3 of 4 for this task.

Performer's Name ____________ **Analyst(s)** ____________ **Dept.** ________
Job Title ____________ **Institution** ____________ **Date** ________

List Elements

d. Performer places the transducer as appropriate to the structure(s) being examined. Angles the ultrasonic beam as appropriate:

i) For the pericardial sac, heart valves,and heart chambers, places the transducer first on the third, fourth or fifth intercostal space slightly to the left of the sternum,and directs the beam posteriorly. For pericardial effusion may direct the beam posteriorly and slightly laterally. For mitral valve may direct the beam posteriorly and medially.
ii) In a young child may place the transducer directly over the sternum.
iii) May place transducer to the right of the sternum and direct the beam medially.
iv) May place the transducer below the sternum and direct it towards the head, or above the sternum and angle it caudally.
v) For aortic arch, right pulmonary artery, and/or left atrium, places transducer at the suprasternal notch,and directs the beam caudally. For left atrium combines ultrasonogram from the suprasternal notch with one from the left of the sternum. For left innominate vein,angles beam slightly to the left.
vi) If using strip-chart recording, may change the direction of the ultrasonic beam while maintaining transducer in the same location.

e. Makes a preliminary echocardiogram to check the position of the transducer and adjust the technique. Corrects as appropriate.

f. For pericardial effusion,checks for an echo-free zone between the pericardium and one or more walls of the heart.

List Elements

i) Identifies anterior heart wall motion and posterior heart wall motion.
ii) Checks for size of effusion by noting whether it is seen anteriorly or only posteriorly.
iii) Notes maximum excursion of the heart walls.
iv) Checks for possible tamponade by noting greatest amplitude of motion and noting any significant decrease in motion. Reports signs of tamponade at once.
v) Records as appropriate.
vi) May check for errors in interpretation such as echoes from other mediastinal structures or pleural effusion. May check by repositioning transducer or moving patient to see whether pleural fluid moves away from heart (as in Task 627).

g. For study of mitral valve,performer positions transducer until the maximum motion of the mitral valve is visualized. Records.

i) Moves beam toward the annulus and inferiorly to record echoes of annulus and papillary muscles.
ii) Checks the "Point E" pattern of mitral valve at which it is completely open (highest point).
iii) Measures the descent towards closing by measuring the slope of the closing motion of the anterior leaflet in mm/sec using the calibrated time and distance axes on the display. Records. May evaluate for mitral stenosis.
iv) May check for excessive mitral valve motion such as in mitral insufficiency.
v) May check for a fluttering motion of valve.

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
This is page 4 of 4 for this task.

Code 635

Performer's Name__________ **Analyst(s)**__________ **Dept.**__________
Job Title__________ **Institution**__________ **Date**__________

List Elements	List Elements
vi) May evaluate a prosthetic mitral valve as described. Notes echoes from the artificial element as well as characteristic patterns. h. For study of the aortic arch, right pulmonary artery, left innominate vein, left atrium, evaluates the motion of the structures. i) To determine lumen size, measures the echo-free zone. ii) May use high gain to record the inferior wall of the left atrium. iii) Notes that little motion may be seen with older patients and those with fibrillation. iv) Uses knowledge or records on normal values to identify abnormalities such as cardiovascular disease, rheumatic heart disease, congenital heart disease. v) For determination of left atrial size uses suprasternal ultrasonogram to measure the cephalocaudad diameter, and left anterior chest ultrasonogram to measure the AP diameter.	

TASK CODE	EXTENDED TASK NAME
636	Making B-scan, A-mode and M-mode ultrasonograms of the fetal heart in utero for calculation of fetal heart rate, by reviewing request; planning procedures; setting up equipment; reassuring and preparing pregnant patient; locating fetus with B-scan mode; marking fetal outline; using A-mode to detect characteristic fetal heart echoes; maintaining transducer position and converting to M-mode; making photographic records; measuring fetal heart rate based on calibrated time and distance axes on the display; recording or presenting preliminary interpretation, measurements; identifying ultrasonograms; recording examination; placing ultrasonograms, records for use.
637	Using Doppler ultrasonic motion detector to detect or monitor the fetal heart in utero by reviewing request; transporting and/or setting up Doppler equipment; reassuring and preparing pregnant patient or patient in labor; moving transducer over the maternal abdomen and locating fetal heart; differentiating from maternal vessels,or placenta,or fetal movement; deciding to combine with B-scan ultrasonograms if appropriate; noting abnormalities; recording examination and preliminary interpretation; recording or presenting results; placing records for use.
638	Using Doppler ultrasonic motion detector to evaluate blood flow, pressure, occlusion in neonate or any patient by reviewing the request; transporting and/or setting up doppler equipment; setting up for audible signal and/or strip chart recording; explaining, reassuring patient or parent; preparing patient; positioning transducer (under blood pressure cuff if taking infant blood pressure); checking for characteristic sounds or strip record of stoppage and return of arterial wall motion, presence or absence of blood flow, change of pitch over stenotic segment; recording examination and preliminary interpretation; recording or presenting results; placing records for use.

TASK IDENTIFICATION SUMMARY SHEET

This is task ___ of ___ for this performer.
Code 639 This is page 1 of 2 for this task.

Performer's Name__________ **Analyst(s)**__________ **Dept.**__________
Job Title__________ **Institution**__________ **Date**__________

1. What is the output of this task? (Be sure this is broad enough to be repeatable.)

Diagnostic ultrasound equipment checked; tests of transducer, amplifier, horizontal and vertical controls, system registration, axial and lateral resolution, transducer dead zone made; time-distance calibration, dynamic range capability and gray scale tested; accuracy evaluated against test standards; malfunctions reported or adjustments arranged; test results recorded.

2. What is used in performing this task? (Note if only certain items must be used. If there is choice, include everything or the kinds of things chosen among.)

Diagnostic ultrasound equipment, display oscilloscope, transducer, controls, camera, film; test object of plexiglass or water-filled with reflector; electronic gray scale test device; manufacturer's manuals or instructions; test records; log book; pen; phone; out-of-order sign

3. Is there a recipient, respondent or co-worker involved in the task? Yes...(X) No...( )

4. If "Yes" to q. 3: Name the kind of recipient, respondent or co-worker involved, with descriptions to indicate the relevant condition; include the kind with whom the performer is not allowed to deal if relevant to knowledge requirements or legal restrictions.

Co-worker; supervisor

5. Name the task so that the answers to questions 1-4 are reflected. Underline essential words.

Carrying out standard tests and calibration checks of diagnostic ultrasound equipment by reviewing procedures; carrying out tests of transducer, amplifier, horizontal and vertical controls, system registration, axial and lateral resolution, transducer dead zone, time-distance calibration, dynamic range capability and gray scale of imaging system; checking accuracy against known standards; having adjustments made and/or reporting malfunctions; recording checks and results.

List Elements

Performer carries out regular tests and calibration checks of diagnostic ultrasound equipment as a result of:

a. Request from co-worker.
b. Decision to do personally.
c. Regular assignment.

1. Performer determines what type of check is appropriate, depending on any reported malfunction or problem found personally, or makes checks on a regular, periodic basis, based on the type of equipment involved:
   a. If appropriate, reviews instructions supplied by manufacturer on in-house calibration checks and standards.
   b. May check the transducer and amplifier by setting controls at predetermined test positions and making ultrasonogram in appropriate mode, such as A-mode.
      i) Uses a plexiglass block or water filled phantom with a known reflector inside, or other appropriate test object, such as AIUM approved test object.
      ii) Applies gel or oil as couplant to phantom.
      iii) Applies transducer and adjusts gain control.
      iv) Checks that echoes appear in predetermined pattern, size, number, at appropriate height on amplitude axis.

OK-RP;RR;RR

6. Check here if this is a master sheet..(X)

TASK IDENTIFICATION SUMMARY SHEET (continued)

This is task ___ of ___ for this performer.
Code 639 This is page 2 of 2 for this task.

Performer's Name________________ Analyst(s)________________ Dept.________
Job Title________________ Institution________________ Date________

List Elements

c. May check horizontal and vertical controls by setting up standardized test stations.

  i) Adjusts intensity as appropriate to provide dots or pips for test on display.
  ii) Checks that dots line up with intersections on the graticule as appropriate in both the vertical and horizontal planes.

d. May check the overlap of images of one target viewed from two different directions (system registration), the image size of a point target (axial and lateral resolution) and the transducer "dead zone" by following appropriate test procedures.
e. Monitors the resolution capability of the system by measuring the image size of line targets in the standard test object.
f. May check the time-distance calibration by setting controls for test as appropriate, adjusting baseline. Checks that the echoes produced with the display scale being used line up as appropriate with the major divisions of the graticule, with equidistant spacing.
g. May check the time-distance calibration by making ultrasonogram of the phantom whose reflector is at a known distance from the transducer.

  i) Checks that the distance from the transducer artifact to the reflector echo (known) corresponds to the depth distance indicated on the display at the scale being used.
  ii) May repeat test, moving the display to various portions of the display screen. May use varying phantoms with a variety of test distances. May use varying gain settings.

List Elements

  iii) May calculate a correction in the calibration figure used for measurements.

h. May measure the dynamic range capability and gray scale of the imaging system using a gray scale test device and following standard test procedures.
i. Performer may make photographic records as in regular diagnostic procedures. Records test results.

2. Performer reports any problems that must be dealt with by other staff or service organization to appropriate person. May arrange to have service organization called, or decides to do personally.

3. If appropriate, shuts down machine until service personnel complete corrections. May place out-of-order sign on machine.

4. When checks and/or any in-house adjustments have been carried out, may record what was done, date, and results in a record book or log sheet. May sign. Places record in appropriate location for filing if appropriate.

CHAPTER 6

INDEX OF TASKS BY CODE NUMBER FOR RADIATION THERAPY AND ULTRASOUND

This chapter presents an index of all the tasks represented in this report as task descriptions, task summaries, or extended task names. The column on the right indicates whether the task can be located in Chapter 3, on radiation therapy, and/or in Chapter 5, on ultrasound technology. The letter R is used to designate radiation therapy, and the letter U for ultrasound. If the task also appears in Research Report No. 7, it is marked D (for diagnostic radiology); if the task appears in our ambulatory care pilot test, it is also marked A (for ambulatory).

TASK CODE	ABBREVIATED TASK NAME	SOURCE*
69	Processing exposed x-ray film in automatic processor.	R, D,A
72	Loading x-ray film cassette(s), nonscreen film holder(s), box(es), and/or roll film cartridges.	R, D,A
76	Checking supplies and ordering non-drug materials needed by department.	R,U,D,A
77	Providing emergency care for any patient having adverse reaction to radiographic contrast medium, procedures, or accident.	R, D

---

* The letters have the following meanings: R (radiotherapy) means that the task appears in Chapter 3 of this report; U (ultrasound) means that the task appears in Chapter 5 of this report; D (diagnostic radiology) means that the task also appears in Research Report No. 7; A (ambulatory) means that the task also appears in Research Report Nos. 4 and 5.

TASK CODE	ABBREVIATED TASK NAME	SOURCE
78	Checking and jacketing patient's radiographs, ultrasonograms, and/or C.T.T. scans with requisition sheets and prior diagnostic materials and placing for filing or interpreting.	U,D
79	Preparing barium sulfate contrast medium as ordered for standard use.	R, D,A
80	Preparing materials or trays with medications and materials for special treatments or procedures according to standard orders.	R, D,A
116	Deciding on and/or arranging for transportation for outpatient to and/or from treatment or examination.	R, A
124	Arranging to cover temporary or permanent staff shortages.	R, A
129	Checking supply and ordering non-narcotic medicinals needed by department.	R, D,A
131	Making assignments of staff to work areas, procedures, and/or MD's and/or vacations and lunch hours.	R, D,A
134	Logging and/or tallying patient services and/or instructional case record materials for use in record keeping, billing or instruction.	R,U,D,A
135	Cleaning an examination or treatment room after use.	R,U,D,A
136	Checking and storing order for non-narcotic drugs and/or supplies.	R, D,A
143	Catheterizing any female urethra as ordered.	R, D,A
151	Preparing treatment or examination room(s) for use.	R,U, A
159	Checking on reasons for non-appearance of out-patients for examination or treatment and arranging for rescheduling.	R,U, A
164	Filling out patient identification information on labels and forms in anticiption of need or as requested.	R,U,D,A
178	Checking, preparing fluoroscope controls (and phototimer).	R, D
181	Catheterizing any male or female patient's urethra with retention balloon catheter.	R, D

TASK CODE	ABBREVIATED TASK NAME	SOURCE
182	Setting up and using suction machine to clear airway or to assist with gastric lavage.	R, D,A
186	Orienting new staff member(s) to departmental standard operating and administrative procedures, floor plan, location of equipment and supplies, record keeping.	R, D,A
190	Assisting patient to or from wheelchair, stretcher, bed, or table and/or transporting patient to designated area.	R,U,D,A
193	Having any patient and materials prepared for special procedure and readying patient for examination.	R, D,A
194	Administering eye or ear drops to any patient on orders.	R, A
195	Applying an eye patch for any patient on orders.	R, A
198	Administering medication orally to any patient according to MD's orders after having quantity checked.	R, D,A
265	Filing or obtaining records from files by patient identification number and/or name.	R,U, A
267	Processing exposed Polaroid x-ray film with Polaroid automatic processing equipment.	R, D
269	Loading empty cassette with Polaroid x-ray film.	R, D
272	Preparing and adjusting schedules for patient procedures.	R,U,D
274	Adding predetermined instruments and supplies to prepared procedure trays.	R, D
278	Checking on reasons for nonappearance of in-patients for examinations or treatment.	R,U,D
280	Participating in monitoring of personal exposure to radiation by periodically turning in and replacing film strip in badge worn by performer.	R, D
282	Escorting adult out-patients to and/or from dressing rooms, treatment rooms and/or waiting areas.	R,U,D
294	Assigning subordinate and explaining assignment to transport patient, obtain materials or documents, or assist co-worker.	R, D

TASK CODE	ABBREVIATED TASK NAME	SOURCE
298	Administering medication orally to any patient according to MD's orders.	R, D
319	Applying print coater to photographs.	R,U,D
327	Participating in monitoring of personal exposure to radiation by periodically turning in and replacing film strip in badge; evaluating posted exposure listings.	R, D
354	Obtaining patient records for use in examination, procedure, treatment or conference.	R,U,D
374	Taking tomograms of non-infant patient.	R, D
490	Mummying or wrapping an infant or young pediatric patient.	R, D
520	Preparing any patient and attaching electrodes for electrocardiogram monitoring.	U,D
526	Taking computerized transverse axial tomographic (C.T.T.) scans of any patient.	R, D
527	Retrieving, displaying and making photographs, printouts and/or magnetic tape records of computerized transverse axial tomographic (C.T.T.) scans.	R, D
561	Planning and arranging for pre-treatment procedures for external beam radiation therapy.	R
562	Participating in discussion on, or answering questions about, external beam radiation therapy equipment in relation to proposed treatment plan.	R
563	Carrying out simulation and/or initial set-up for any patient to receive external beam radiation therapy of the head, neck, and/or spinal column, using simulator or treatment machine.	R
564	Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the thorax, such as lungs, pleura, esophagus, mediastinum, using simulator or treatment machine.	R

TASK CODE	ABBREVIATED TASK NAME	SOURCE
565	Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the breast(s), using simulator or treatment machine.	R
566	Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the lymph nodes with mantle and/or "inverted-Y" field techniques or variations, using simulator or treatment machine.	R
567	Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the whole abdomen, or female patient to receive external beam radiation of the reproductive system, using simulator or treatment machine.	R
568	Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the whole pelvis, urinary bladder, or male patient to receive external beam radiation of the prostate, using simulator or treatment machine.	R
569	Carrying out simulation and initial set-up for male patient to receive external beam radiation therapy of the testis, using simulator or treatment machine.	R
570	Carrying out simulation and initial set-up for male patient to receive external beam radiation therapy of the penis, using simulator or treatment machine.	R
571	Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the kidney and/or adrenal glands or neuroblastoma, using simulator or treatment machine.	R
572	Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the bone and/or soft tissue of an extremity, using simulator or treatment machine.	R
573	Carrying out simulation and/or initial set-up for any patient to receive external beam radiation therapy of the whole body.	R
574	Preparing a contour drawing at the appropriate treatment level(s) of any patient to receive external beam radiation therapy.	R

TASK CODE	ABBREVIATED TASK NAME	SOURCE
575	Taking transverse axial tomograms of any patient.	R
576	Assisting as ordered with localization, simulation and/or initial set-up procedures for any patient to receive external beam radiation therapy, using simulator or treatment machine as ordered.	R
577	Applying lead contact or spatula-type internal eye shield under any radiotherapy patient's eyelid.	R
578	Inserting radiopaque probe into female patient's vagina to localize tumor or cervix.	R
579	Inserting balloon catheter or barium enema in any patient's rectum to localize tumor or rectum.	R
580	Taking photograph(s) of any patient's face and/or treatment areas as ordered.	R
581	Discussing, planning and arranging for mold room procedures to fabricate treatment devices such as shells, casts, masks, applicators, beam blocks, bolus, shields, etc., for use in radiation therapy.	R
582	Fabricating a treatment shell or mask of plaster of Paris bandages using direct technique for radiotherapy patient.	R
583	Fabricating a treatment mold or applicator or solid cast for radiotherapy patient from dental impression compound, and/or plaster of Paris, or liquid resin acrylic, or stone plaster, using indirect technique.	R
584	Preparing an intracavitary or surface applicator mold to receive radioactive sealed sources.	R
585	Preparing a solid cast of plaster of Paris or stone plaster for use as model in treatment planning or for shaping lead shields.	R
586	Forming a plastic radiotherapy treatment shell from a solid or positive cast of plaster of Paris or stone plaster, using a vacuum forming machine.	R
587	Making an intraoral or surface stent or dental wax cast impression of a radiotherapy patient.	R
588	Fabricating a bite-block or other radiotherapy treatment mold from a wax cast.	R

TASK CODE	ABBREVIATED TASK NAME	SOURCE
589	Preparing a lead bite-block or other lead block for radiotherapy use from a wax cast set in plaster mold.	R
590	Applying wax bolus to a radiotherapy treatment shell.	R
591	Fabricating lead shielding for radiotherapy treatment fields.	R
592	Fabricating and shaping radiotherapy lead shielding or mask cutouts on a plaster cast of radiotherapy patient.	R
593	Cutting treatment portals out of radiotherapy treatment shell.	R
594	Fabricating a contact or spatula-type internal eye shield for radiotherapy.	R
595	Fitting a radiotherapy treatment shell to a patient, fixing to supports and/or attaching straps.	R
596	Preparing and/or arranging external beam radiotherapy beam blocks or compensating filters of prescribed shape and HVL for use in shadow tray.	R
597	Fabricating radiotherapy styrofoam molds for beam blocking using marked radiograph, treatment geometry and a hot wire cutting device.	R
598	Fabricating customized lead radiotherapy shielding beam blocks with styrofoam molds.	R
599	Setting up any radiotherapy patient and administering external beam radiation therapy to the head and/or neck and/or spinal column.	R
600	Setting up any radiotherapy patient and administering external beam radiation therapy to the thorax, for treatment of lungs, pleura, esophagus, or mediastinum.	R
601	Setting up any radiotherapy patient and administering external beam radiation therapy to the breast(s).	R
602	Setting up any radiotherapy patient and administering external beam radiation therapy to the lymph nodes with mantle and/or "inverted-Y" field techniques or variations.	R

TASK CODE	ABBREVIATED TASK NAME	SOURCE
603	Setting up and administering external beam radiation therapy to whole abdomen of radiotherapy patient or female patient to receive external beam radiation of the reproductive system.	R
604	Setting up and administering external beam radiation therapy to the whole pelvis or urinary bladder of a radiotherapy patient or male patient to receive external beam radiation of the prostate.	R
605	Setting up a male radiotherapy patient and administering external beam radiation therapy to the testis.	R
606	Setting up a male radiotherapy patient and administering external beam radiation therapy to the penis.	R
607	Setting up any radiotherapy patient and administering external beam radiation therapy to the kidney and/or adrenal glands.	R
608	Setting up any radiotherapy patient and administering external beam radiation therapy to the bone and/or soft tissue of an extremity.	R
609	Setting up any radiotherapy patient and administering external beam radiation therapy of the whole body.	R
610	Reassuring any radiotherapy patient and/or accompanying family member about external beam radiotherapy procedures.	R
611	Explaining to any out-patient or accompanying family member proper at-home procedures to follow prior to coming for radiation therapy treatment.	R
612	Preparing external beam treatment equipment with appropriate attachments.	R
613	Calculating and recording, or checking and reporting errors in calculations, in external beam radiation treatment plan or in therapy chart, such as effective area, dose time or monitor units, central axis depth dose, prescribed total tumor dose versus total given dose, according to predetermined formulae, using appropriate information.	R

TASK CODE	ABBREVIATED TASK NAME	SOURCE
614	Adding and recording accumulated given doses and/or weekly final tumor doses, or checking and reporting calculation errors, in radiotherapy treatment charts.	R
615	Planning and arranging procedures for intracavitary or interstitial radiation therapy (brachytherapy).	R
616	Reassuring any radiotherapy patient and/or accompanying family member about intracavitary, or interstitial implant, or instillation, or remote afterloader procedures.	R
617	Calculating treatment time for remote afterloader intracavitary radiation treatment or checking calculation.	R
618	Reinforcing or informing internal radiation therapy patient about expected reactions to therapy, self care, and danger signs to report.	R
619	Taking localization films of intracavitary applicator or interstitial implant prior to treatment of a radiation therapy patient.	R
620	Assisting radiotherapist in application and/or removal of intracavitary applicator for remote or conventional afterloader radiation treatment of any patient.	R
621	Transporting sealed radioactive isotopes within institution from storage to treatment area safes following appropriate safety precautions.	R
622	Taking localization radiographs and administering intracavitary radiation therapy with remote afterloader to any internal radiation therapy patient.	R
623	Making B-scan ultrasonograms of a pregnant patient and fetus.	U
624	Making B-scan ultrasonograms of a female patient's pelvis to study reproductive organs, pelvic masses.	U
625	Making B-scan ultrasonograms of any patient's abdominal contents, such as liver, gallbladder, pancreas, and/or spleen.	U
626	Making B-scan ultrasonograms of any patient's kidney(s).	U

TASK CODE	ABBREVIATED TASK NAME	SOURCE
627	Making B-scan ultrasonograms of any patient's thoracic contents to study mediastinal masses, pulmonary emboli, pleural lesions, and/or pleural effusion.	U
628	Making B-scan ultrasonograms of superficial mass(es) of any patient.	U
629	Making B-scan ultrasonograms of any patient to differentiate free fluid from fixed fluid, such as in ascites.	U
630	Making A-mode echoencephalograms of any patient.	U
631	Making A-mode and B-mode scan ultrasonograms of a fetal skull in utero.	U
632	Loading camera for photography of oscilloscope display; making exposures on orders; recording patient identification, date, series number, level and directional reference.	U
633	Reassuring any patient and/or accompanying adult about diagnostic ultrasound procedures and/or explaining prior fluid intake if appropriate.	U
634	Making B-mode scan and A-mode ultrasonograms of any patient's abdominal aorta.	U
635	Making M-mode echocardiograms of the heart and pericardium of any patient.	U
636	Making B-scan, A-mode and M-mode ultrasonograms of the fetal heart in utero for calculation of fetal heart rate.	U
637	Using Doppler ultrasonic motion detector to detect or monitor the fetal heart in utero.	U
638	Using Doppler ultrasonic motion detector to evaluate blood flow, pressure, occlusion in neonate or any patient.	U
639	Carrying out standard tests and calibration checks of diagnostic ultrasound equipment.	U

RELATING TECHNOLOGIST TASKS IN DIAGNOSTIC RADIOLOGY, ULTRASOUND AND RADIATION THERAPY

Research Report No. 10

by
Eleanor Gilpatrick, Director
Health Services Mobility Study

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EMPLOYMENT AND TRAINING ADMINISTRATION
U.S. Department of Labor

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CHAPTER 1

ABOUT THIS REPORT

INTRODUCTION

The Health Services Mobility Study (HSMS) has applied its method of task analysis, job ladder design and curriculum analysis to the technologist, technician, and aide levels in diagnostic radiologic technology, diagnostic ultrasound, and radiation therapy, including quality assurance and patient care functions. This report deals with job ladder and job lattice relationships among the tasks in these fields.

HSMS research is concerned with the nature of task groupings, the content and job levels of tasks, and the implications for job ladders and curriculum design. This report discusses possible job ladder and job lattice options to take individuals from entry level jobs to technologist and junior professional level occupations. The report includes curriculum outlines for the design of educational ladders to parallel the job ladder recommendations.

The research was designed to answer specific questions. With respect to task groupings, we were interested in the number of groupings that would emerge, whether they would echo the division along specialty lines, and which tasks would appear at similar job levels within groupings.

With respect to job ladders, we were interested in whether there are job ladder possibilities from the aide to technologist levels, and whether such progressions would cut across the three specialty areas or remain within them.

With respect to curricula, we were interested in whether it would be appropriate to have a core of introductory curricula combining the three technologic specialties, whether preparation in any of the three programs would justify entry with advanced standing into any of the other programs. We were interested in learning whether the practice of offering a one-year radiation therapy technologist program (instead of the usual two-year program) for individuals who are registered radiologic technologists or registered nurses is appropriate, especially when such one year programs are the same for technologists and nurses. HSMS also questioned whether training in radiologic technology should be a prerequisite for entry to a program in diagnostic ultrasound technology.[1]

STRUCTURE OF THIS REPORT

Chapter 1 presents a summary of the research results and background material. The HSMS job structure and job ladder-lattice recommendations are presented in Chapter 2. Chapter 3 discusses curriculum requirements for educational programs that would parallel the job ladders. It describes the HSMS curriculum outlines and indicates how the outlines can be used in conjunction with HSMS task descriptions to design curriculum objectives for the job structures described in Chapter 2. Chapter 4 presents the technical content of the HSMS method, and describes the analytic work.

---

[1] The radiation therapy technologist curriculum has only recently been separated from that of the radiologic technologist; the diagnostic ultrasound technologist function is only now beginning to emerge in separate formal curricula.

The five appendixes at the end of this report contain the detailed statistical and technical material that underlie the conclusions. Table 1 in Appendix A lists, by order of Task Code Number, the abbreviated names of all the tasks that entered into the analysis.[2] There are 296 tasks represented. The table shows the task grouping (factor) and job level to which each task was assigned.

The basic statistical data for the analysis are the HSMS skill and knowledge category scale values assigned to each of the tasks. The scale values for each task reflect what an individual must know in order to perform the task. Table 2 in Appendix A presents each of the skill and knowledge categories identified for any of the 296 tasks and the factor structure which describes the interrelationships among the skill and knowledge "variables."

Appendix B contains the heart of the job analysis results. It includes Tables 3 through 8, each of which presents a task factor (grouping). The tasks assigned to each factor are listed in descending order of difficulty within job levels based on HSMS "point scores." The tables also present the loadings of the tasks on their factors. These tables are the basis for the HSMS job structure and job ladder recommendations. The tasks in these tables are assigned to job levels

---

[2] The task descriptions and summaries in Research Report No. 9 and in Volumes 2 and 3 of Research Report No. 7 are the basis of this report. This volume refers to the tasks solely by their abbreviated names and/or by their code numbers.

1 (aide), 2 (technician), 3 (technologist), 4 (junior professional), and 5 (professional). Tasks within factors at levels 1, 2, and 3 are the occupational-educational groupings of tasks for which the curriculum outlines were designed; they provide the basis for the job and educational ladder sequences.

The scales used for rating the tasks on their skill and knowledge requirements are presented in Appendix C. There are sixteen skill scales and a knowledge scale that is used with all the knowledge categories. (A task frequency scale is also included; however this scale is not used in the analysis of the data.)

Appendix D includes the curriculum requirements for the job structures recommended, and presents HSMS curriculum outlines for four job and educational sequences.

Appendix E presents examples of HSMS curriculum objectives. These can be used as models for developing curriculum objectives from the HSMS task descriptions in Research Report No. 9 and the curriculum outlines in this report.

SUMMARY OF RESULTS

1. The tasks in radiologic technology, diagnostic ultrasound technology, and radiation therapy technology fall into five major groupings. Two groupings contain the diagnostic examinations in (1) radiologic technology and (2) ultrasound; the third contains set-up, simulation and treatment tasks in radiation therapy. The fourth and fifth groupings contain patient care oriented tasks and quality assurance-materials oriented tasks. The latter two groupings contain tasks which can service all three of the

specialties to varying degrees. Many of the tasks in these two groupings overlap across the three specialty departments.

2. The examination tasks in diagnostic radiography and ultrasound are at technologist levels of difficulty using the HSMS criteria (the number of HSMS skill and knowledge categories and the scale values at which they are required). Fewer categories are required for ultrasound technology, but many are required at higher scale values than for diagnostic radiography. The result is a somewhat higher "point score" difficulty index for ultrasound technology.

3. The simulation, initial set-up, and treatment tasks in radiation therapy and some tasks for organizing and planning mold room activities or procedure sequences are at technologist levels of difficulty using the HSMS criteria. More categories are required and many are needed at higher levels than in radiologic technology or ultrasound; the "point score" difficulty index is highest for radiation therapy technology.

4. The job ladders identified in Research Report No. 8 were found again. One starts at the entry (aide) level, deals with materials and equipment, proceeds to a technician level in radiologic quality assurance, and then enters the radiologic technologist level, with options to continue into supervision and education or to branch out and upwards toward the job of radiation physicist. However, with the inclusion of tasks from Research Report No. 9, the aide and technician level jobs can be expanded to include similar and related tasks to service the ultrasound function and especially to service radiation therapy.

   The new job of quality assurance technician, identified in Research Report No. 8, can be expanded to include equipment calibration and testing and transportation of sealed radioactive sources in radiation therapy, and calibration of equipment in ultrasound. This would expand work assignments and thus more institutions would have the volume of work necessary to support this new structure in separate jobs.

5. The second job ladder identified in Research Report No. 8 starts at the entry (aide) level, deals with patient-oriented activities, proceeds to a technician level in patient care, and then

enters the radiologic technologist level, with options to continue into supervision and education or towards specialized or emergency patient care. With the inclusion of tasks from Research Report No. 9, it is apparent that this function can be expanded at the aide and technician levels to service radiation therapy and ultrasound. There also should be the option to branch out and upwards to diagnostic ultrasound technology as well as to radiologic technology, creating a third job ladder possibility.

6. A fourth job ladder was identified during the analysis done for this report. It begins at the broadly-based quality assurance-materials aide level and goes to the technician level in radiation therapy technology, with options to continue into supervision and education.

   A new job structure is suggested for the radiation therapy technician. It includes assistance with simulation and/or treatments, making calculations, and carrying out mold room activities.

7. No evidence was found to justify any requirement that a program in diagnostic ultrasound technology or radiation therapy technology must be preceded by a program in radiolgoic technology. These are three distinct technologist-level specialties, and none should be a prerequisite for any other.

8. There is justification for offering advanced standing in a technologist-level program to individuals who can demonstrate mastery in required subject areas as a result of having completed one of the other technologist programs or an RN program. There is some overlap of subject matter, especially between radiologic technology and radiation therapy technology. However, each program provides a different set of capabilities, and the subjects for which students could be exempted would have to be different for each program. A blanket reduction of the radiation therapy program from two years to one with no difference in required content for registered nurses or radiologic technologists cannot be justified on educational grounds.

9. There is evidence to justify the development of core curricula for all three technologist programs in several subject areas such as regional and topographic anatomy, the normal struc-

ture and function of the systems of the body, shock and trauma, first aid, and handling of the sick or wounded. There is more in common between radiation therapy and diagnostic radiography than between ultrasound and diagnostic radiography.

10. The analytic work made it possible to present currciulum outlines for educational sequences and programs for the new job structures. These cover patient care aide to patient care technician, quality assurance-materials aide to quality assurance technician, patient care technician to diagnostic ultrasound technologist, and radiation therapy technician to radiation therapy technologist. These can be used in conjunction with HSMS task descriptions to develop curricula for any of these job structures and/or to parallel the HSMS job ladder recommendations.

BACKGROUND

This section briefly reviews the objectives of the HSMS task analysis method, the data base, and touches on those aspects of the task, skill, and knowledge components of the method not already covered in Research Report No. 9.

Objectives

Two of the major goals of the HSMS task analysis method are the design of job ladders and the development of curricula for educational ladders to parallel the job ladders. The intent is to assign tasks to groupings that require related skills and knowledges, and assign the tasks within each grouping to job levels so that the tasks within each job level in a given grouping require similar levels of the skills and knowledges that characterize the group. (Later in this report the groupings are called "factors," since the groupings are arrived at through factor analysis.)

For HSMS, a job ladder is a logical progression from one job to another within an interrelated grouping of tasks. As a result, an individual's training for and experience in a lower-level job on a ladder is preparation for the next level on the ladder, and the additional training and education needed for the next step on the ladder is kept to a minimum. If the progression up the ladder can reach professional levels, it is legitimate to call the job ladder a "career ladder."

The HSMS method analyzes tasks in terms of skill and knowledge requirements, groupings, and levels. This kind of analysis makes it possible to assign work duties to job titles rationally; management can make better use of more highly trained and more expensive employees, and can, at the same time, have all the work carried out by staff who are properly trained to provide quality output. It makes little economic sense to assign low-level tasks to high-level personnel; it makes little social sense to assign high-level tasks to staff at lower levels when they are improperly trained to carry them out.

The design of job ladders means that there is an opportunity for employees to move ahead within the institution; the individual's investment in current training becomes an investment in the future. Success in a given job means mastery of the skills and knowledges that will also be needed at higher levels; future training can be expected to require related skills and knowledges, and/or higher levels of skills and knowledges already familiar in the current work. Also, the next step up the ladder is likely to be observable to the employee while he or she is operating in the current job.

Having job ladders means that employees can be trained to reach their maximum potential and also can have socially useful, income-producing jobs along the way which reinforce their training. Each rung on a ladder is an interim option to work; and continuing education or later reentry to a program to continue up the ladder are also options. Work and training need not be mutually exclusive; employees can support themselves and institutions can have the benefit of their training at one level while they are in preparation to move up to the next level on the ladder; the current work can only benefit from this.

The HSMS analytic approach also makes it possible to uncover lattice relationships among task groupings. While groups of tasks often have mutually exclusive skill and knowledge requirements, some groupings have a great deal of overlap. Especially at the early stages when the investment in specialized training is not great, such cross-over possibilities and lateral movement from job to job are desirable. Some of the original training investment is still applicable, and a change in the direction of the upward movement from one set of skills and knowledges to another is possible with little wasted training.

The social investment in health services lies primarily in the education and training of health manpower; yet one finds workers in health servies occupations locked into dead-end jobs. At the same time, shortages exist for properly trained professional and skilled personnel. One also finds shortages of educational facilities while schools continue to require redundant training. In the face of rising costs and the demand for quality patient care, improper allocation of functions to personnel, redundancy of training requirements, and non-transferability of much lower-level training create an indefensible waste. We hope that HSMS reports can be used to eliminate such waste. We also hope that our attention to and concern with the quality of performance (as reflected in our tasks and in our skill and knowledge scaling) will result in improved patient care.

Coverage

The 296 tasks listed in Appendix A, Table 1, are the basic units of analysis. (The coverage is fully described in Research Report No. 7, Volumes 2 and 3, and Research Report No. 9.) These are tasks in diagnostic radiology covering the aide, technician, and professional levels in quality assurance; the aide, technician and junior professional levels in patient care; the examination tasks of the radiologic technologist;[3] and tasks (in Research Report No. 9) in radiation therapy and diagnostic ultrasound. The data base for this report excludes tasks in radiologic technology and quality assurance that deal with teaching or attendance at meetings, since these were not included for radiation therapy or ultrasound.

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[3] Eleanor Gilpatrick, Task Descriptions in Diagnostic Radiology, Research Report No. 7, New York: Health Services Mobility Study, 1976. (See Preface. Volumes 2 and 3 contain many of the tasks included in the data base for this report.)

The analysis done for this report duplicates the results of the prior task analysis in diagnostic radiology[4] and incorporates new information and insights gained by including the tasks in ultrasound and radiation therapy. Among these, radiologic technology tasks are fully covered; the tasks in radiation therapy technology are fairly well represented at the technologist level, with equipment testing, some patient care and some materials-related functions not included. Diagnostic ultrasound is least fully covered; the technologist tasks should be considered to be only prototypes.

The statistical analysis for this report is based on the skill and knowledge requirements for the 296 tasks. Among these, we consider the data for diagnostic radiography to be more valid and reliable than the data for radiation therapy and ultrasound, because there was less time for follow-up review of the data in the latter two cases.

ANALYTIC COMPONENTS

Tasks

The HSMS method of job analysis begins with task analysis, as described in Research Report No. 9. The HSMS definition of task conceives of the task as a work activity unit in which the "performer" combines existing technology, knowledge, materials, and equipment with skills to produce units of output. The task is a unit of work which can be moved from one job to another without disrupting other activities. Once identified, a task has a code number, an abbreviated name, and an extended task name; most tasks also have a full task description or a summary.

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[4] Eleanor Gilpatrick, Using Task Data in Diagnostic Radiology, Research Report No. 8, New York: Health Services Mobility Study, 1977. (See Preface.)

The Task Code Number assigned to the task stands uniquely for the contents of the task and covers the task's output, what is used, the kind of recipient or respondent dealt with, and how the task is done. Regardless of the job title, institution, or industry in which the task is found, it always has the same code number.

Skills, Knowledge Categories and Scaling

The HSMS method was designed as a system. It includes a set of skill scales, a Knowledge Classification System, and a knowledge scale, all of which can be used in any context.[5] This provides a consistent, underlying taxonomy that makes possible the comparison of tasks in terms of their skill and knowledge requirements.

The categories found in the Knowledge Classification System are arranged in outline form by major disciplines, with eight-digit code designations which reflect a category's degree of indentation in the outline.

The HSMS scales were developed with the use of a statistical process known as Thurstone Scaling, or equal-appearing intervals.

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[5] The scales are presented in Appendix C. The knowledge categories identified for the 296 tasks included in the analysis are presented in Appendix D, Table 9. For a full presentation of the HSMS method, see: Eleanor Gilpatrick, The Health Services Mobility Study Method of Task Analysis and Curriculum Design (four volumes; Volume 4 by Eleanor Gilpatrick and Christina Gullion), Research Report No. 11, New York: Health Services Mobility Study, 1977.

As a result, the scales have characteristics which permit them to be treated as statistical variables. It is the scale values of each task on the skill and knowledge variables that are the inputs to the statistical analysis.

The skills and knowledge categories have the property of being teachable, so that all the skill and knowledge data we collect about the tasks can be translated into curricula.

The HSMS analysts scale each task on each of the skill scales; they identify the HSMS Knowledge Classification System categories needed to perform each task, and assign a scale value to each category using the HSMS knowledge scale. This process includes interviews with performers in the field. When the analysts are sure of their scaling, they prepare forms which indicate, not only the scale values for skills and knowledge for each task, but the specific part of each task description or summary to which a given skill or knowledge category scale value refers. This process ensures careful, reliable, and valid work on the part of the analysts and relevant data for use as an input to curriculum design.

The skill and knowledge data go through an in-house check to ensure that the scales are being applied consistently and appropriately. Teams review each others' work, and a senior staff member reviews all the work comparing similar or related tasks to one another.

For a given set of tasks, there are scale value data on 16 skill variables and the number of knowledge category variables equal to the number of categories identified for the entire set of tasks. Each task is represented once and only once in the analysis. A description of the analysis for this report is presented in Chapter 4.

CHAPTER 2

JOB STRUCTURES, LADDERS AND LATTICES FOR RADIOLOGIC TECHNOLOGY, ULTRASOUND TECHNOLOGY AND RADIATION THERAPY TECHNOLOGY

This chapter describes the relationships among tasks in diagnostic radiography, diagnostic ultrasound, and radiation therapy. It presents the HSMS job structure, job ladder and job lattice recommendations.

The reader who wishes to understand how we arrived at the results is invited to read Chapter 4 at this time. For the general reader who is interested in our recommendations, this chapter can be read without Chapter 4 if the following simple definitions are kept in mind:

1. Each skill and each knowledge category is a scaled variable. Tasks are rated for the skill and/or knowledge scale values required for their performance. These scale values are the HSMS task data.

2. The word factor means grouping. Task factors are groupings of tasks that are interrelated.

3. The way skills and knowledge categories group together in factors determines the way tasks can be grouped together in factors.

4. Factors are named for the skill, knowledge, and work context of the tasks in the factors.

5. The assignment of tasks to job levels means arranging tasks in a factor (group) so that tasks which require similar skills and knowledges at similar scale values are assigned to corresponding and appropriate job levels.

6. HSMS uses a specific job level convention: "aide" (1) refers to the entry level; "technician" (2) refers to less than associate degree educational requirements; "technologist" (3) refers to the

equivalent of associate degree preparation; "junior professional" (4) refers to educational and/or supervisory or specialty functions beyond the technologist level, up to but not including the baccalaureate degree; "professional" (5) refers to baccalaureate or masters degree preparation or equivalent specialized education.

7. The task factors to which this report refers are as follows:

   Radiologic Technology
   Radiation Therapy Technology
   Diagnostic Ultrasound Technology
   Quality Assurance, Materials Related Functions
   Patient Care Functions
   Administrative Functions (a non-factor).

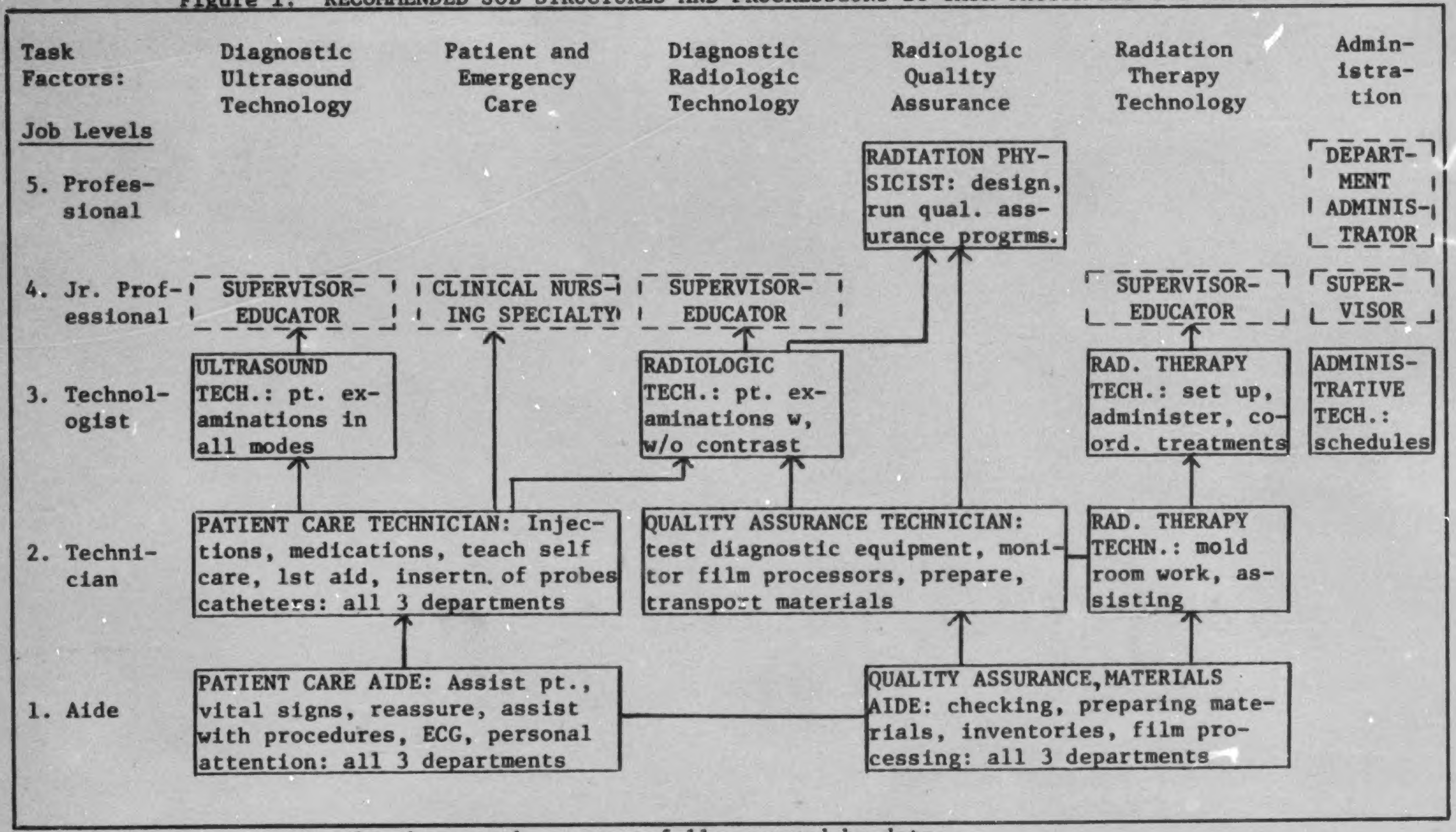
JOB STRUCTURE RECOMMENDATIONS

The HSMS analysis provides strong evidence that the technologist functions in diagnostic ultrasound, radiation therapy and diagnostic radiography are separate and distinct. These activities are clearly separable from lower-level functions such as generalized patient care and quality assurance and are largely separate from one another. Other support activities such as in the mold room in radiotherapy are at lower levels.

Figure 1: Summary of Recommendations

The results of the analysis and our job structure and job ladder recommendations are summarized in Figure 1. The analysis produced five distinct groupings of tasks (task factors) and a miscellaneous group of administrative tasks. Figure 1 shows in graphic form the task factors, the types of tasks assigned to job levels within factors, and the job structures we recommend. The job progression and

Figure 1: RECOMMENDED JOB STRUCTURES AND PROGRESSIONS BY TASK FACTOR AND JOB LEVEL


Task Factors:
Job Levels
Diagnostic Ultrasound Technology
Patient and Emergency Care
Diagnostic Radiologic Technology
Radiologic Quality Assurance
Radiation Therapy Technology
Administration
5. Professional
4. Jr. Professional
3. Technologist
2. Technician
1. Aide
RADIATION PHYSICIST: design, run qual. assurance progrms.
DEPARTMENT ADMINISTRATOR
SUPERVISOR-EDUCATOR
CLINICAL NURSING SPECIALTY
SUPERVISOR-EDUCATOR
SUPERVISOR-EDUCATOR
SUPERVISOR
ULTRASOUND TECH.: pt. examinations in all modes
RADIOLOGIC TECH.: pt. examinations w, w/o contrast
RAD. THERAPY TECH.: set up, administer, co-ord. treatments
ADMINISTRATIVE TECH.: schedules
PATIENT CARE TECHNICIAN: Injections, medications, teach self care, 1st aid, insertn. of probes catheters: all 3 departments
QUALITY ASSURANCE TECHNICIAN: test diagnostic equipment, monitor film processors, prepare, transport materials
RAD. THERAPY TECHN.: mold room work, assisting
PATIENT CARE AIDE: Assist pt., vital signs, reassure, assist with procedures, ECG, personal attention: all 3 departments
QUALITY ASSURANCE, MATERIALS AIDE: checking, preparing materials, inventories, film processing: all 3 departments

Broken boxes represent jobs whose tasks are not fully covered by data.
For task content, see tables in Appendix B.

job lattice possibilities are also indicated. The job progressions allow for upward mobility from the aide level to the supervisory, junior professional or professional level by several different routes. The tables in Appendix B present the tasks in each factor arranged by job levels. Each solid box in Figure 1 represents the tasks in a given factor at a given job level; thus, the Appendix B tables provide the task content underlying Figure 1.

Radiologic Technology: The Technologist and Higher [1]

Level 3 in radiologic technology is the radiologic technologist. The job structure is exactly the same as that obtained in the analysis for Research Report No. 8. This job, as represented in Figure 1, is almost exclusively composed of patient examinations, both plain films and contrast films, taken in the operating room, at the bedside, in the examination room, and in the angiography room. The requirements for these tasks combine much of the content of the patient care factor and the technological content of the quality assurance factor with knowledge of anatomy and physiology. Thus, the job is a logical progression for technicians in quality assurance and patient care.

Two tasks assigned to radiation therapy could also be carried out by radiologic technologists. These involve localization of tumors by means of transverse axial tomography (Task 575) and taking localization films of intracavitary applicators or interstitial implants prior to treatment (Task 619). In our opinion the radiation therapy technologist is a better choice for these tasks because radiation therapy technologists are better equipped to deal with cancer patients and must learn how to take verification films for simulation and treatment in any case.

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[1] Table 3 in Appendix B presents the tasks assigned to the radiologic technology factor.

In many institutions the technologist is expected to carry out many of the tasks which this report places at the aide and technician levels in patient care, quality assurance, or radiation therapy. This means that the training of the technologist, which is usually two or more years, covers aide- and technician-level work as well as the technological specialty, and in no particular sequence. Since the technologist is rarely employed until the entire program is completed, the hospital winds up paying technologist wages for aide- and technician-level work. Throughout the training period, the technologist is unable to utilize a good deal of training and is unemployable (except in cases where clinical training involves payment for supervised work).

In an institution large enough to employ a staff of some size, it would be more sensible to save salary costs and training investments by assigning technologist-level procedures to technologists, and by having technicians and aides carry out lower-level work.

In some large institutions special procedure contrast studies are assigned to "senior" radiologic technologists, and "plain flims" are assigned to lower-rank technologists. The HSMS point score index of difficulty provides no real justification for this distinction. As indicated in Table 3 in Appendix B, the six highest-ranking examinations include computerized transverse axial tomography, conventional tomography, plain films (both pediatric and non-pediatric), and angiograms. The order does not give either contrast studies or plain films greater weight.

In the case of contrast studies, the technologist requires higher levels of knowledge of asepsis and nursing categories, but the radiologist is there to review the radiographs and decide when the diagnostic information is complete. In the case of plain films, the radiologic technologist requires higher levels of decision making skills and categories involved in decisions on what to do, how to do it, and when the examination is at an end.

The level 4 function in diagnostic radiology is for the supervisor and educator. Tasks here are probably best combined with the administrative tasks in non-factor A, which are not sufficient to constitute a separate job. Currently the chief technologist is often saddled with an uneconomic allocation of low-level clerical and administrative tasks or the quality assurance tasks this report assigns to the technician. Perhaps there is a confusion of the essentialness of administrative or testing functions with the level of those functions.

Radiation Therapy Technology: The Technician, The Technologist, and Higher[2]

The role of the radiation therapy technologist continues to increase in responsibility as the field becomes more sophisticated, and as radical cures (as opposed to palliation) are more commonplace. The structure of the field places a great responsibility on the technologist to carry out the intent of the treatment plan. Incorrect geometry in simulation, initial set-up, or in treatment can mean that a radical cure cannot be effected or that sensitive tissue will be damaged. The consequences are life-related, because there are lifetime limits to radiation exposure, and an unsuccessful treatment can bar any further treatments using the radiation mode.

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[2] Table 4 in Appendix B presents the tasks assigned to the radiation therapy technology factor.

With these considerations in mind, HSMS chose to portray the tasks in practice at a major cancer center. What emerges is a clear distinction between technologist-level tasks and technician-level tasks. That is, the HSMS analysis suggests that there are two job levels in this factor and, therefore, two major components of a job ladder progression.

The radiation therapy technician (at level 2) combines the functions of a mold room technician and an assistant in the simulation or treatment room. The most logical entrance to this job is from the aide level in quality assurance, because many of the mold room tasks are highly materials-oriented.

Since most mold room tasks have point scores at the technician level, it makes sense to include in this job structure tasks such as assisting with localization, simulation, and initial set-up (Task 576), calculating or checking dosages (Tasks 613, 617, and 614), and setting up external beam treatment equipment (Task 612). This combination (preparing the patient and the equipment) puts the technician in contact with ongoing work with the patient and prepares the individual to deal knowledgeably at a later time with the realities of cast, shell, and equipment limitations. This division of work follows an apprenticeship-style progression and leads logically to the radiation therapy technologist.

The radiation therapy technologist (at level 3) is equipped to treat cancer patients according to prescription, to do localization, simulation, and initial set-up for treatment, and is able to function with most treatment modes and all types of treatment field arrangements.

Point score analysis indicates that, for any given treatment area, simulation and initial set-up requires more training than setting up and administering treatment after the initial set-up. However, as indicated in Table 4 of Appendix B, the six highest-ranking tasks include four simulation tasks and two treatment tasks. There is therefore no educationally-based justification for having a separate, senior simulation room technologist. Indeed, there may be an advantage to the patient in having the continuity of attention provided by having one technologist first carry out simulation and initial set-up and then do treatment.

This technologist-level job structure includes discussing, planning, and arranging for mold room procedures (Task 581), participating in discussions about equipment capabilities (Task 562), and making treatment shells directly on the patient (Tasks 583, 582). These functions are logical progressions from the technician level.

In addition, this job structure includes planning and arranging for pre-treatment, intracavitary or interstitial procedures. These activities could be combined with other administrative functions to create a separate technologist job. Having experience in the work could provide insights and sensitivity to the problems. These tasks can also be incorporated into level 4, the supervisor-educator.

Diagnostic Ultrasound: The Technologist and Higher[3]

The diagnostic ultrasound technologist (at level 3) is able to carry out patient examinations in each ultrasound mode. In practice, the technologists tend to specialize by area of the body, especially in large institutions. An interesting aspect of this job structure is that it requires fewer subject categories than for the two radiation technologies. However, the fact that the ultrasound technologist must make preliminary diagnoses in order to determine what permanent scan records to make results in the need for higher scale values for many skills and knowledges.

The data suggest that there is less in common between this job structure and the other two technologist structures than between diagnostic radiography and radiation therapy. These technologist tasks include a nursing component similar to the one for radiologic technology, but there are few connections on the quality assurance side. It seemed more appropriate to allocate the few equipment-related tasks (which are below the technologist level) to a general quality assurance technician job than to create a separate quality assurance technician level job in ultrasound. Therefore, the job progression we recommend goes from patient care aide to technician, and then leads to ultrasound technologist.

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[3] Table 5 in Appendix B presents the tasks assigned to the diagnostic ultrasound technologist factor.

Level 4 in diagnostic ultrasound would be the job of the supervisor-educator. For this report, no data were collected for tasks at this level.

Quality Assurance: The Physicist, The Technician, and The Aide

The growing interest in patient and staff safety in diagnostic radiology has been given expression in a new professional specialty which finds physicists employed by hospitals as staff members or consultants. Hospitals need such experts to plan, set up, and maintain safe installations. They need programs in equipment testing, film processor monitoring, and patient and staff radiation monitoring. They need a system to guarantee that diagnostic-quality radiographs are produced with minimum exposure to patients and staff. These concerns and needs are underlined in recent legislative requirements concerning equipment standards. The need to check periodically that equipment meets those standards is now mandated. We call this entire area "quality assurance."

The task analysis results in Research Report No. 8 suggest that jobs could exist in this factor at three separate levels. The data in this report suggest that the function and jobs can be expanded to include similar functions in radiation therapy and ultrasound.

The radiation physicist in the field of radiology (at level 5) is needed to design and run radiation protection and quality assur-

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[4] Table 6 in Appendix B presents the tasks assigned to the quality assurance-materials factor.

ance programs and to advise on equipment and installations. Such functions are also needed in radiation therapy,[5] and may soon be called for in diagnostic ultrasound.

The results of Research Report No. 8 suggest a new job, that of the quality assurance technician (at level 2). The tasks in this job would involve carrying out equipment tests, patient and staff radiation exposure monitoring, and film processor monitoring as designed by the physicist. These tasks do not require the same educational preparation as designing and running the programs or even carrying out radiologic technology patient examinations. The task data indicate that a separate job could be created at institutions large enough to support one or more individuals for this function. The number of skill and knowledge categories needed for this job is actually fewer than those needed for the job of radiologic technologist, and suggests the technician level.

The data on tasks in Research Report No. 9 suggest further assignments to fill out this job so that it services radiation therapy and ultrasound as well as diagnostic radiology. The job can include radiotherapy equipment testing for quality assurance similar to that mandated for diagnostic radiography equipment. The technician in this job structure is also the natural one to transport sealed radioactive sources following safety precautions (Task 621), and the logical one to do calibration checks of ultrasound equipment (Task 639).

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[5] Physicists are used in radiation therapy treatment planning and dosimetry. Such tasks have not been covered in this report.

The appeal of this job structure for relatively large institutions is that it can minimize costs while maximizing quality. Technicians can do the testing work while technologists are free to carry out examinations or treatments, and physicists are free to carry out higher duties as staff members or consultants. For the physicist or technologist this means being relieved of relatively routine work; for the aide who many now be carrying out darkroom or other similar tasks, the technician's job means a step up on the job ladder.

The job of quality assurance-materials aide (at level 1) combines tasks which currently cut across diverse job titles. The preparation of procedure trays, for example, can be found in nursing or technologist titles; cleaning examination rooms can be a housekeeping or nurse aide assignment. We combine these tasks with those of film processing, starting up or shutting down equipment, preparing subtraction prints, and even tasks of tallying and handling records and carrying out inventories and clerical tasks. The unifying thread is the need to pay attention to details, to be scrupulously careful about cleanliness, contamination, and accuracy. These tasks truly relate to safety and quality with respect to records, materials, and equipment. They have little to do with direct patient contact; they become direct lead-ins to the job of the quality assurance technician.

Many of these tasks overlap across departments and are needed in radiation therapy and ultrasound as well as in diagnostic radiology. We suggest that these tasks should be assigned to a separate job title at the aide level to service all three departments, with rotation of specific groups of assignments. This would make maximum use of the limited body of skills and knowledges needed to carry out any of the tasks. The diversity of the procedures could be a protection against employee boredom, and is not an argument against such a job structure.

Patient Care: The Aide, The Technician and Higher[6]

The job of patient care aide (at level 1) is comparable to that of the quality assurance aide. It brings together diverse lower-level activities. In this case each task deals directly with the patient. The unifying thread here is the need to treat the patient with dignity, sympathy, and understanding, as well as to give careful attention to the patient's well-being. The factor assigns to the patient care aide preparation for ECG monitoring; monitoring is then picked up at the technician level. Many of the tasks involve measuring patient symptoms and functions.

Most of these functions can service patients in diagnostic radiology, radiation therapy, and ultrasound. Specific tasks, such as reassuring patients about ultrasound procedures and explaining prior preparation (Task 633) or a counterpart task for radiation therapy (Task 611) are assigned here, since they require little further training. This job structure brings together a variety of tasks which provide diversity while utilizing a relatively narrow set of skills and knowledges common to the tasks in the group.

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[6] Table 7 in Appendix B presents the tasks assigned to the patient care factor.

The patient care technician job structure (at level 2) includes tasks currently being done by registered nurses, technologists, and/or practical nurses. Grouped at the technician level in this factor, they provide a logical step up for the patient care aide and build on the skills, knowledges, and task experiences at level 1.

Three tasks are included in level 2 that are more appropriate at a technologist level in patient care (Tasks 299, 133, and 296). HSMS considered whether a technologist level (3) is present for patient care. In two tasks the performer administers subcutaneous or intramuscular injections, and in one administers first aid in an emergency. The tasks require more knowledge categories than others at level 2. However, we did not feel that three tasks warrant the structuring of a separate technologist job in patient care.[7]

The patient care technician job structure includes tasks that might be carried out by higher-level staff but could be taught to technicians. These include assisting with intracavitary applicators before and after radiation treatment (Task 620), inserting shields and probes (Tasks 577, 578, 579), and reinforcing instructions or reassuring about radiation therapy procedures (Tasks 610, 616, 618).

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[7] All the other level 2 tasks can be learned in a program of much narrower scope than that leading to the registered nurse license. We suggest, therefore, that, should these tasks be able to be assigned to a patient care technician, the additional training for these three tasks could be provided. Since in some states only an RN is allowed to carry out the injections, special permission to function in these tasks would have to be obtained.

The nursing training offered in the usual RN or LPN program may be broader than is needed to service the three departments; however, such programs may omit tasks such as ECG monitoring, the preparation of specimens for the laboratory, or providing patients with procedure-related information. Appropriate training for this job structure can be extracted from current LPN or RN programs and supplemented as needed so that reentry with credit to LPN and RN programs is a possible option further along in an individual's career progress.

Level 4 in the patient care factor could be a supervisor-educator; however, two of the tasks involve emergency care. This suggests a broader-based nursing specialty in emergency life support. The two tasks do not constitute a separate job; they are an indication that there should be an option into a nursing specialty after reentry to the factor, perhaps at the missing technologist (RN) level.

Administration: The Technologist, The Supervisor and The Department Administrator[8]

The tasks assigned to levels 3 and 4 of Non-factor A do not constitute separate jobs. At level 5, the department administrator is a current job that was not studied in detail.

The level 3 tasks deal with departmental functioning, such as scheduling patients and staff and making assignments. Level 4 tasks relate to the supervision and evaluation of staff. These tasks should be combined with tasks in other factors at comparable levels.

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[8] Table 8 in Appendix B presents the tasks assigned to non-factor A.

The department administrator runs the daily functions of the department, coordinates operations, makes major purchasing decisions, or carries them out. This job, at level 5, might benefit by being filled by someone who has a broad knowledge of the work of all the staff rather than a detailed knowledge of one or two functions, and by someone who has progressed through the level 3 and 4 administrative tasks of scheduling and supervision.

CAREER LADDER AND LATTICE RECOMMENDATIONS

Overview

The HSMS job ladder recommendations are arrangements of jobs in promotional steps derived from the task factors. The jobs in the ladder require interrelated skill and knowledge categories. There are also suggestions on job lattices. Job lattices allow for linkages across ladders both horizontally and diagonally. This provides crossover options and a choice of promotional pathways based on the principle that the skills and knowledges required at a given level for a factor may serve as a basis for more than one specialty. A given specialty may build on more than one kind of prior preparation; the entry to specific professional jobs could thus be reached through more than one factor. Conversely, a given job level in a factor can be a step towards more than one specialty.

The Job Ladder Progressions

Three of the job ladders begin with the quality assurance-materials aide. Two continue to quality assurance technician, and one continues to radiation therapy technician. From quality assurance technician an individual should be able to opt to continue in an educational program leading to radiation physicist or to continue with a program leading to radiologic technologist. From radiation therapy technician an individual should be able to opt to continue in an educational program leading to radiation therapy technologist.

The interrelationship of the skills and knowledges needed for radiologic technology and quality assurance makes it possible to sequence the training in a radiologic technology program in such a way that a student would be prepared for employment as a quality assurance aide and a quality assurance technician while in the process of being trained to be a radiologic technologist. Similarly, the training for radiation therapy technology can be sequenced so that the student would be prepared as a radiation therapy technician while in the process of being trained to become a radiation therapy technologist.

Very little training would go to waste; employment would be available to students part way through the educational program; and students not qualified to complete the program would be able to offer marketable job preparation, at least at the aide or technician level.

With educational programs sequenced this way, small institutions that require radiologic technologists to perform quality assurance technician tasks, or that require radiation therapy technologists to perform technician tasks, could opt for the full complement of training. On the other hand, large institutions could save on costs by hiring at the technician level, saving the technologists for examination or treatment functions.

The fourth, fifth, and sixth job ladders begin with the patient care aide and continue to patient care technician. At this point an individual should be able to choose to continue in an educational nursing program leading to licensure and eventual clinical or emergency care specialities, or to continue with a program that prepares him or her to be a radiologic technologist or an ultrasound technologist.

The nursing skills and knowledge required for radiologic technology and ultrasound technology make possible sequences from the aide to the technician levels in patient care, leading to technologist functions in radiography or ultrasound.

Cross-over lattice possibilities are the basis for the options into radiologic technology from the patient care and quality assurance ladders and from patient care to ultrasound. The patient care technician and quality assurance technician both have training that is sufficiently transferable and relevant (although different in each case) for continuing towards radiologic technology, ultrasound, nursing, or physicist occupations. Another cross-over option appears between quality assurance technician and radiation therapy technician.

There is also a cross-over lattice possibility at level 1. A decision at the entry level to change one's direction from people-oriented to equipment- and materials-oriented work is not a waste of much training investment, since few specialized knowledge categories are required and the skill requirements are transferable. Such career line options should be available early to allow individuals to find the orientation best suited to their needs, interests, and abilities.

CHAPTER 3

CURRICULUM REQUIREMENTS AND CURRICULUM OUTLINES

This chapter discusses the educational requirements for the job structures and job progressions presented in Chapter 2. It describes the HSMS curriculum outlines presented in Appendix D and indicates how the outlines can be used in conjunction with HSMS task descriptions to develop curriculum objectives for the jobs and sequences discussed.

CURRICULUM REQUIREMENTS

The HSMS skill and knowledge data provide a basis for determining the curriculum content of occupational programs. Having grouped the tasks by factor and job level (as described in Chapter 4), and having arranged these task groupings into job structures, it is possible to state curriculum requirements, to make comparisons from one occupational-educational grouping (job structure) to another, and to design curriculum sequences to lead from one job structure to another.

Table 9 in Appendix D presents the skills and knowledges required by nine of the job structures discussed in Chapter 2. These include the aide and technician in patient care, the aide, technician, and physicist in quality assurance, the technician and technologist in radiation therapy, and the technologists in diagnostic ultrasound and radiography. Table 9 indicates which of these job structures (which we treat as occupational-educational units) requires each of the skills and knowledge categories and at what scale values. The scale values are presented in ascending order from top to bottom. By examining the table the user can ascertain what each educational-occupational unit requires and how its requirements compare with those of every other unit. Inspection of the table demonstrates the rational basis of the factor structures. There are distinctions among the factors with respect to the knowledge categories required, the extent to which they rise by job level, and the actual levels required.

The information presented in Table 9 makes it possible to answer some of the questions posed at the beginning of this report:

1. Do the educational requirements for the three technologist-level job structures warrant that a program in any one be a prerequisite for entry into a program for any other?
2. Is it justifiable on educational grounds to cut in half the requirements in a radiation therapy program for graduates of a radiologic technology program or a registered nurse program?
3. Are the curriculum requirements for any one job structure sufficiently similar to those of any other to warrant entrance with advanced standing in one based on successful completion of another?
4. Would it be appropriate to offer core courses which would serve all three technologist programs?

HSMS calculates an index of difficulty for tasks by considering the number of skill and knowledge categories and the scale value at which each is required for a task. This is called a "point score." Point scores can be averaged, and this makes it possible to compare point score indexes across job structures. The point scores and factor results help answer the above four questions.

As Figure 2, below, indicates, diagnostic radiography technology requires 66 separate skill and knowledge categories, but has the lowest point score average of the three technologist job structures (even though ultrasound technology requires fewer skill and knowledge categories). The largest number of categories and the highest point score is required for radiation therapy technology. These figures suggest that the three occupational-educational units are probably different from one another in significant ways.

Figure 2. COMPARISON OF POINT SCORE AVERAGES AT LEVEL 3

Technologist	No. of Tasks*	No. of S & K Categories	Point Score Average
Diagnostic Radiography	73	66	64.3
Diagnostic Ultrasound	14	60	73.8
Radiation Therapy	32	81	75.6

*Excludes Task 280

Figure 3 presents the results of a comparison of radiologic technologist requirements with ultrasound requirements and with radiation therapy requirements. In each case we took the highest scale value at which an educational-occupational unit requires a skill or knowledge category and compared requirements. We asked, which are required at the same scale value, which higher, which lower, and which categories are uniquely required by an educational-occupational specialty?

As Figure 3 indicates, radiologic technology shares only seven skills and eight knowledge categories at the same scale value with ultrasound, but nine skills and 21 knowledge categories (almost half its requirements) with radiation therapy. There are 20 skill and

Figure 3

COMPARISON OF LEVEL 3 TECHNOLOGIST CURRICULUM REQUIREMENTS

Radiologic Technology and Ultrasound Technology

Skill and knowledge categories in common at same (highest) scale value[a]:	15
Skill and knowledge categories needed at higher scale value for radiography:	8
Skill and knowledge categories needed at higher scale value for ultrasound:	22
Skill and knowledge categories required only for radiography:	20
Skill and knowledge categories required only for ultrasound:	15

Radiologic Technology and Radiation Therapy Technology

Skill and knowledge categories in common at (highest) scale value[b]:	30
Skill and knowledge categories needed at higher scale value for radiography:	7
Skill and knowledge categories needed at higher scale value for radiation therapy:	20
Skill and knowledge categories required only for radiography:	8
Skill and knowledge categories required only for radiation therapy:	24

[a] Categories in common at the same (highest) scale values include seven skills, normal structure and function, regional and topographic anatomy, shock and trauma, operative procedures, deliver methods for childbirth, first aid, and handling and transportation of the sick or wounded.

[b] Categories in common at same (highest) scale values include nine skills, regional and topographic anatomy, the anatomy and physiology of the organs of the stomach, small intestine, larg intestine and biliary system, and eye, disorders affecting the circulatory system, respiratory system, musculoskeletal system, shock and trauma, surgery, operative and introductory procedure anesthesiology, first aid, bandages and dressings, handling and transportation of the sick, dru idiosyncrasy, death and dying behavioral development, algebra, and the mechanics of writing English.

Source: Appendix D, Table 9.

knowledge categories needed at lower scale values for radiologic technology than for radiation therapy, and 22 needed at lower scale values for radiologic technology than for ultrasound. However, there are also several (7 or 8) needed at higher levels for radiologic technology.

Fifteen separate categories are needed for ultrasound that are not covered by radiologic technology, while 24 are needed for radiation therapy. On the other hand, radiologic technology requires 20 categories not required for ultrasound and 8 not needed for radiation therapy. We have three fairly distinct sets of requirements with some overlaps. There is greatest similarity between radiologic technology and radiation therapy. We therefore conclude the following:

1. There is no reason to make any technologist program a prerequisite for any other technologist program. The three sets of requirements have enough in common to indicate that there would be a good deal of redundancy if such a sequence were required. On the other hand, the three sets of requirements are sufficiently different to make it a waste of time for an individual to have to master any two technologies in order to practice one of them.

2. The requirements for nursing (patient care) are clearly different from those for radiologic technology. There can be no educational justification for an arbitrary halving of the requirements for a program in radiation therapy technology offered to registered nurses and radiologic technologists. The overlap is different for each, and, therefore, elmination of overlap with radiation therapy requirements would require separate programs.

3. There _is_ reason to consider providing a substantial amount of exemption with credit or advanced standing for radiologic technologists who wish to study to become radiation therapy technologists and some amount of exemption or advanced standing for radiologic technologists who wish to study to become diagnostic ultrasound technologists.

4. It would be appropriate to offer core courses in the early part of programs for the three technologies. Such core courses could include regional and topographic anatomy, shock and trauma, operative procedures, first aid, and handling and transportation of the sick or wounded.

CURRICULUM GUIDELINES AND OUTLINES

Educational Ladders

An educational ladder is a related, sequential set of educational courses or programs that provides for continuous educational movement to parallel the movement along a job ladder from its entry-level job to its highest-level job. An educational ladder provides exit credentials for each intermediary job that is reached at the end of each program in the sequence. Such sequences do not require repetition of course work when an individual reenters the educational process to continue up the ladder (aside from the necessary reinforcement or refresher work needed to bring the student up to date in competence).

For such upward mobility to be possible, the student must be able to build on his or her knowledge and skills in cumulative steps. The HSMS task analysis and curriculum design method assumes that a deep, broad understanding of a given knowledge area can be reached in successive, incremental steps, and that skills can also be learned in incremental steps. The concept that skills and knowledges are teachable incrementally is expressed in the HSMS skill and knowledge scales; this use of scaling makes it possible to design job ladders and educational ladders.

Assuming the transferability and the additive nature of the HSMS skills and knowledges, HSMS task data can be used to identify the necessary curriculum content for each step in a job sequence and to identify the educational gap between levels. For any two job structures the difference between the highest scale value for each skill and knowledge category required at a particular job level and the highest scale value for skills and knowledges required at the next level, plus any new skills and knowledge categories needed at the next level, defines the educational gap between levels.

Curriculum Guidelines

The HSMS curriculum design method includes the development of educational objectives, curriculum outlines to parallel job structures and job ladders, behaviorally stated curriculum objectives (which state the application of academic disciplines as job-relevant intended learning outcomes), suggestions for instructional planning, and instructional materials. A full scale development of "curriculum guidelines" was presented in Research Report No. 8.

Research Report No. 9 includes the "desiderata" for radiation therapy and ultrasound technology; these are the bases for some of the educational objectives that would be incorporated in curricula. Appendix D contains the curriculum outlines for four suggested job sequences. (These are discussed below.) Later in this chapter the reader is provided with a mini-manual for converting the task descriptions and summaries into curriculum objectives using the curriculum outlines and Appendix E as guides. We repeat some comments on instructional planning presented in Research Report No. 8; and the task descriptions and summaries in Research Reports Nos. 7 and 9 are usable as instructional materials. Thus, this report offers a partial set of curriculum guidelines for the technologist function in radiation therapy and ultrasound. Time did not permit a more detailed development of the guidelines.

Curriculum Outlines

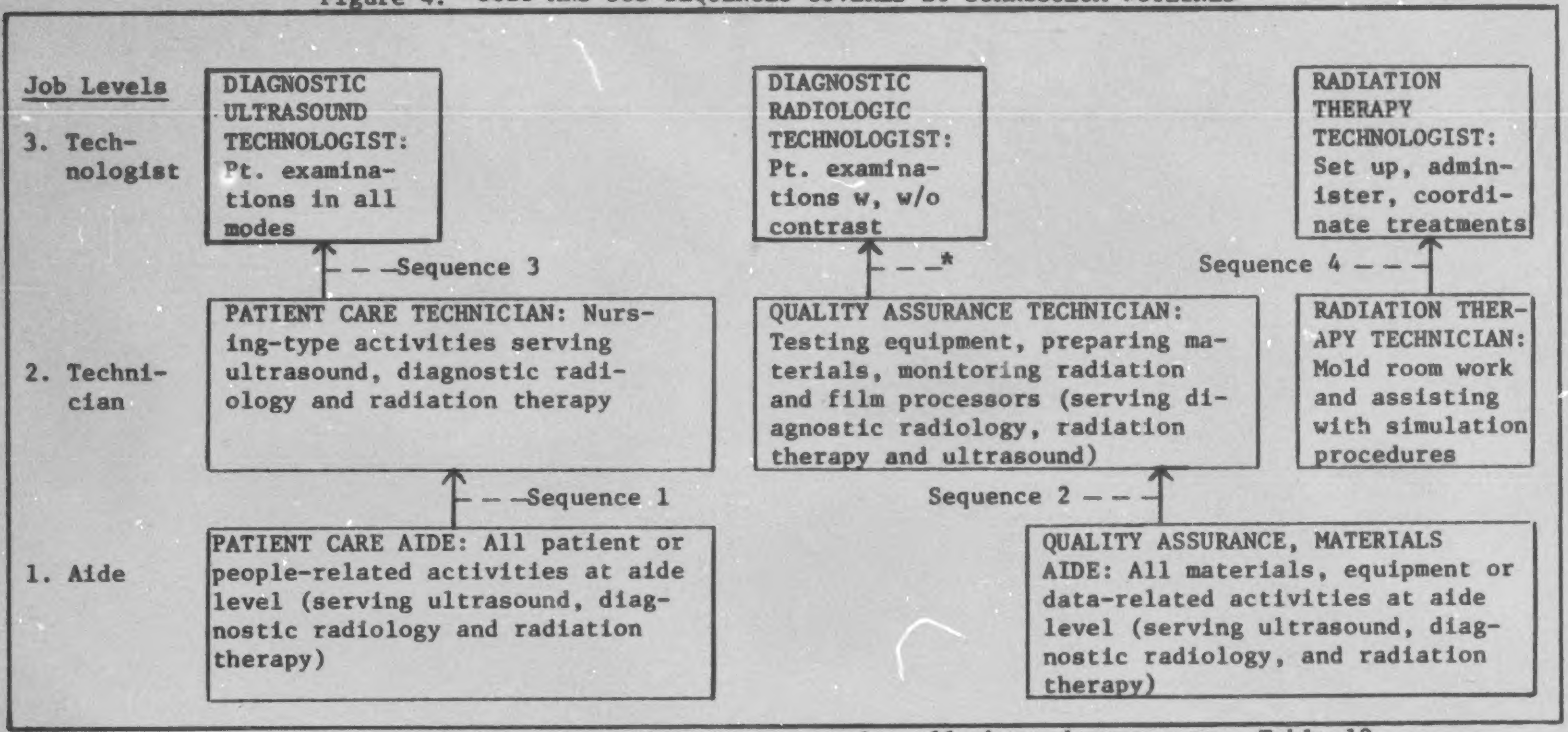
HSMS curriculum outlines are referenced to the job structures which emerge after factor analysis. The tasks assigned to each job level within a factor are the occupational-educational units for which curricula are designed. The curriculum outline for any given occupational-educational unit lists each skill and each knowledge category required by any of the tasks in the unit, with a separate listing for each scale value required. The tasks which require the skill or knowledge category at a given scale value are also shown. They are the reference units for the preparation of curriculum objectives. The units to which the curriculum outlines and curriculum objectives refer are able to be combined into educational sequences or aggregated for consolidated educational programs. With proper planning of sequences much of the material required for a higher-level occupational-educational unit can be covered at one or another lower level or can be anticipated in the instructional planning at lower levels. Thus, the curriculum outlines make it possible to do long-range curriculum planning and to design educational ladders.

We suggest that the curriculum for any radiologic, ultrasound, or radiation therapy technology should be arranged to parallel one or more job ladders, and that the first one or two steps should require no more than the equivalent of half the preparation now required for licensure or certification. The programs should prepare individuals in sequences which qualify them to exit after completion of early course work to take aide and/or technician jobs, or to continue to the technologist level. Students should be allowed to enter or reenter the program upon successful demonstration of mastery of the objectives at the earlier levels. Students should then be able to proceed beyond the technologist level to levels 4 and/or 5 as in Figure 1.

Figure 4 reproduces the job structures (occupational-educational units) at job levels 1, 2, and 3 shown in Figure 1. It suggests four possible one-step sequences which can be used in educational ladders. Sequence 1 is from patient care aide to patient care technician. Sequence 2 is from quality assurance-materials aide to quality assurance technician. Sequence 3 is from patient care technician to diagnostic ultrasound technologist. Sequence 4 is from radiation therapy technician to radiation therapy technologist. (A fifth sequence, from quality assurance technician to radiologic technologist was presented in Research Report No. 8 and will not be discussed in this report.)

Appendix D, Tables 10 through 13, contains the curriculum outlines for each of the occupational-educational units involved in the four sequences of Figure 4. Each table contains the name of the skill or knowledge category required, its scale values, and the Task

Figure 4. JOBS AND JOB SEQUENCES COVERED BY CURRICULUM OUTLINES


Job Levels
3. Technologist
2. Technician
1. Aide
DIAGNOSTIC ULTRASOUND TECHNOLOGIST: Pt. examinations in all modes
DIAGNOSTIC RADIOLOGIC TECHNOLOGIST: Pt. examinations w, w/o contrast
RADIATION THERAPY TECHNOLOGIST: Set up, administer, coordinate treatments
Sequence 3
*
Sequence 4
PATIENT CARE TECHNICIAN: Nursing-type activities serving ultrasound, diagnostic radiology and radiation therapy
QUALITY ASSURANCE TECHNICIAN: Testing equipment, preparing materials, monitoring radiation and film processors (serving diagnostic radiology, radiation therapy and ultrasound)
RADIATION THERAPY TECHNICIAN: Mold room work and assisting with simulation procedures
Sequence 1
Sequence 2
PATIENT CARE AIDE: All patient or people-related activities at aide level (serving ultrasound, diagnostic radiology and radiation therapy)
QUALITY ASSURANCE, MATERIALS AIDE: All materials, equipment or data-related activities at aide level (serving ultrasound, diagnostic radiology, and radiation therapy)

Sequence 1: from aide to technician in patient care, serving all three departments: Table 10.
Sequence 2: from aide to technician in quality assurance-materials, serving all three departments: Table 11.
Sequence 3: from patient care technician to ultrasound technologist: Table 12.
Sequence 4: from radiation therapy technician to radiation therapy technologist: Table 13.
* This sequence from quality assurance technician to radiologic technologist is covered in Research Report No. 8, Volume 2.
Tables appear in Appendix D.

Code Numbers of the tasks in the given occupational-educational unit which require the skill or knowledge at that scale value. The data are arranged in separate columns for each occupational-educational unit.

A program designer can use each column individually to design separate occupational programs. Reading down the column for one unit provides information for the curriculum outline for that unit. By reading across the rows, the program designer can determine whether a given skill or knowledge at a given scale value has been covered or will be covered in the other unit of the sequence, and can decide how to make use of this to consolidate instruction or provide for exemptions or advanced standing.

The program designer can combine curricula across several outlines presented in Appendix D. The tables also make it possible to order the curricula so that activities at lower scale values of the skills and knowledges are taught before higher ones are taught. The program designer can examine all the skills and knowledges and decide on the best order of presentation from the point of view of logic or the nature of the disciplines. The outlines can be combined for any sequence or combination of jobs.

Since these tables list the Task Code Numbers associated with each skill or knowledge by scale value, the tables can serve as indexes of the task descriptions which are usable as instructional materials.

Sequencing Within Programs

The curriculum outlines of Appendix D present the skills first, followed by knowledge categories in the code number order of the Knowledge Classification System. Within each category the outlines start with the lowest scale value and proceed upwards. For any given program, sequencing by scale value is the most logical way to present any given skill or knowledge category. It is also appropriate to present a broad subject category before its component subdivisions. The tables take this into account.

However, it is certainly not appropriate to teach skills first and knowledge categories second. (See the section on skills under Instructional Planning, below.) In fact, it is best to teach skills with the knowledge content to which they are applied. In addition, the order in which knowledge categories appear within the HSMS Knowledge Classification System may not be the most appropriate order for a given occupational program. The sub-categories within broad disciplines have a clear interrelationship reflecting the structure of the disciplines; however, it is an arbitrary function of the Knowledge System coding that the biological sciences come before physics or mathematics, that "normal structure and function" and "pathology" come before "pharmacology," or that these precede "diagnostic radiology" or "interaction with radiation." It was an arbitrary decision that placed the "musculoskeletal system" after several other systems of the body under "normal structure and function."

Part of the responsibility of the program designer and/or instructional planner is to decide on the best ordering of curriculum content. One insight that we offer is that the skills and knowledges that "determine" a given factor are interrelated, and generally rise and fall together. Thus, Table 2 in Appendix A of this report offers some useful information. The table presents the skills and knowledge categories that "determine" the various factors. Those determining a given factor should be considered for joint presentation. There is a possiblity that, since they are interrelated, presenting the material together may enhance the effectiveness of instruction. This is obvious for subjects such as "transducers and rotating machines," "acoustic properties of materials," and "ultrasonics" for ultrasound technology, or "radiotherapy," and "interaction with radiation" for radiation therapy technology, or the categories under "pharmacology" for patient care.

It is also apparent that it is a waste of effort to teach "topographic anatomy," "regional anatomy," or the anatomy and physiology of various systems of the body separately from "positioning" in the three imaging or treatment technologies. This non-functional separation in some program outlines cannot be undone at the level of instructional planning. The decision must be made at the level of program design.

We suggest that, as a general rule, the skill and knowledge objectives that relate to the same task activities be grouped together and taught as a unit. The introduction to the disciplines and skills would come first, followed by the specific content of the disciplines as required in the task situations for the group of curriculum objectives. Laboratory simulation would follow, and then, eventually, clinical practice. Sets of HSMS curriculum objectives could be organized into a sequence of three or four modules which would cover, in sequential fashion, the general academic, laboratory, and clinical content needed to master a particular group of task activities. This approach is valuable for program designers who are preparing modular program structures.

The benefit of this type of task-centered program design is that it is possible to provide the student with an early awareness of how the various disciplines are combined in the clinical situation.

Suggestions For Instructional Planning

The HSMS task descriptions or summaries function as a source of procedural knowledge: the procedures and sequences for the individual tasks. As instructional materials for the classroom and for clinical training, they provide ordered, logical sequences of steps. They suggest what contingencies, options, and emergencies are associated with the tasks, and, for the less familiar specialties, an indication of what is done in a given procedure. The existence of HSMS task descriptions and summaries sometimes provides textual materials that are lacking in newly-emerging areas.

We suggest that skills be taught directly and consciously, and that their salient characteristics be explicitly presented.

Skills dealing with personal interaction, decision making, and cognitive processes are exercised in the application of knowledge. They are the basis of judgment, problem solving, and evaluation. While entire courses of study could be required in the hope that the skills are somehow acquired by students, much could be done to ensure their rapid acquisition within the instructional setting if they are taught purposefully.

The critical distinction between skill and knowledge, given that they are both treated as teachable, is that skills require practice if they are to be learned. Knowledge is learned primarily through didactic means. Skills may sometimes be introduced in an instructional setting, such as in a classroom or lecture room, but actual learning does not take place until there is practice. The basic component in what one learns through "experience" is skill.

We assume that when skills are taught and learned what is transferable are the attributes of the skills (as described in the HSMS scales). This is independent of substantive content. However, while skills can be taught and learned regardless of which specific procedures or knowledges are used to constitute the substantive content when the skill is applied, no skill can be learned without some substantive content. The implication is that what must be taught in each new situation are the knowledges and procedures of the situation. The skill, once learned at a given scale value, is available to the learner for use at that level in another context. We assume that, all other things being equal, a student who has been able to master a task using scale value 3.5 for a given skill has less to learn for a second task which also requires scale value 3.5 for the skill than does someone who has never learned to perform at level 3.5 for the skill in any context. These different contexts are the obvious substantive contents which should be used to teach the skills.

Instruction can be specifically geared to draw on the interrelationships of skills and knowledge, and can utilize the different knowledge areas to specifically develop the skills. The skills can be used to develop the understanding of the knowledge. If instructional planning emphasizes the direct teaching of skills as well as knowledge, needlessly long and unduly inadequate training might be eliminated to an extent not yet imagined.

CURRICULUM OBJECTIVES

The curriculum outlines of Appendix D can be used in conjunction with HSMS task descriptions to develop curricula for any job structure and to parallel the HSMS job ladder recommendations. This section indicates how behaviorally stated curriculum objectives can be written to give educational substance to the outlines in Appendix D.

The units of HSMS-designed curricula are curriculum objectives, i.e., a structured series of intended learning outcomes expressed as statements. HSMS curriculum objectives are written as behavioral objectives in standard formats.

Each HSMS curriculum objective is stated as an intended learning outcome in the language of the tasks to be performed; there are three types of objectives: skill, knowledge, and procedural.

Skill and knowledge objectives state in detail the content which must be learned in order to perform tasks. These objectives specify the type of skill or the area of knowledge to be learned, the level of competence (scale value), and the task activities in which the content must be demonstrated or applied. By presenting the work behavior in combination with the skill or knowledge discipline in the curriculum objectives, we assure job relevance, provide an academic context, and focus on the desired end product. The procedural objectives cover the sequences in which the tasks must be performed; they are referenced to the tasks; thus the task descriptions become useful as instructional materials.

The reader is invited to work with HSMS data and the description of the HSMS curriculum design method which follows to create curriculum objectives for the curriculum outlines presented in Appendix D.[1]

Each curriculum outline in Appendix D shows which skill, knowledge category, scale value, and tasks are covered by each curriculum objective. A curriculum objective should be developed for every skill and every knowledge category at each scale value required for the tasks assigned to each occupational-educational unit.

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[1] Volumes 2 and 4 of Research Report No. 11, op. cit., provide more detailed information and instructions in the HSMS method.

Annotations

HSMS job analysts have scaled each task for the highest scale value of each skill or knowledge category needed to perform each task. The user now marks or indicates the part or parts of each task description or summary in which each skill or knowledge is applied or manifested at the scale value selected.[2]

For certain skills, such as Decision Making on Quality, a comment may need to be written to explain how the skill is manifested, since it can be implicit rather than explicit in the language of the task.

In the case of knowledge categories, a task's scale value for the category depends on the amount or breadth of detailed knowledge needed as well as the depth of understanding required. Therefore, the user should mark all parts of the task that require any knowledge in the given category.

The user should work with two sets of task descriptions or summaries; one should be annotated for skill scale values and the other for knowledge category values. These two sets of annotated task descriptions or summaries are the basic inputs in the process of writing curriculum objectives. (HSMS staff usually photocopies the task descriptions so that each column appears on a separate page next to a blank column on which the annotations are made.)

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[2] The task descriptions or summaries appear in Research Report No. 9 or Research Report No. 7, Volume 3. The scales appear in Appendix C.

Curriculum Objective Coverage

Each job level within a task factor is a discrete occupational-educational unit. Each unit is dealt with separately; each factor is dealt with separately. This provides program designers with the option of combining or separating the curriculum objectives for given skills and knowledges as appropriate to the structure of their programs. For example, the seven units from Figure 4 to be covered by curriculum objectives in this section relate to four factors and three job levels. A program for either of the two technologist programs involved may combine tasks across other factors or levels, even though HSMS recommends particular sequences of programs.

Curriculum Objective Formats

The curriculum objectives in Appendix E provide the format and prototypes for the curriculum objectives.[3] There is one for each skill and one for knowledge. Appendix E presents several examples of knowledge objectives and one for each skill. On each sheet at the top, the basic identification information is filled out as follows:

1. Type of Objective: Whether skill, knowledge, or procedural.
2. Factor: The number of the task factor (not used in this report; factors were referred to by name only).

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[3] Research Report No. 8, Volume 2, contains all the curriculum objectives for radiologic technology at level 3 and most of patient care and quality assurance objectives at the technician and aide levels. Many of these are relevant for the sequences presented in Appendix D and Figure 4.

3. No.: The curriculum objective number. As with tasks, the curriculum objectives are numbered for identification purposes, but the number carries no other special significance.

4. Skill or Knowledge Category: The name of the skill or the code number of the knowledge category.

5. Scale value: The scale value at which all the content of the curriculum objective has been rated.

6. Occupation: The name of the job structure; in this case, names such as patient care aide, quality assurance-materials technician, radiation therapy technologist, etc.

7. Level: The HSMS job level of the job structure and the tasks covered.

8. Refers to Task Code No(s).: The task code numbers of all the tasks that have been scaled at this scale value for this skill or knowledge category and whose language is reflected in this curriculum objective.

9. Is there a Cross Reference?: Yes, if the same skill or knowledge category appears in any other curriculum objective at a lower scale value, at the same scale value, at a higher scale value, or if the skill or knowledge category appears in tasks higher on the job ladder than is represented in the curriculum objectives (such as levels 4 and 5). The footnotes tell the user the numbers of the objectives that are at lower, the same, or higher scale values, or state the higher job level.

Curriculum Objective Content

All the curriculum objectives start out with a classic opening for a behavioral objective: "A graduate of the program at this educational level must be able to...". Each then continues with the content of the curriculum objective. A prototype for each type of curriculum objective has been developed. Each utilizes an HSMS skill or knowledge category, a scale, and relevant task descriptions or summaries. The curriculum objectives for skills and knowledge categories are written so that the reader is not required to know the HSMS method or scales in order to understand what is being referred to by the skill or knowledge category names or the scale values involved.

Each HSMS skill objective has a prototype introductory paragraph that summarizes the kind of behavior that characterizes the skill, regardless of scale value. Most skill objectives end with a prototype paragraph that begins, "To accomplish this, the student must be able to...". These indicate a context for demonstration of mastery. Between the opening and closing paragraphs in any given skill objective the user includes the language of all the task descriptions within the occupational-educational unit that demonstrates the given scale value for the skill. These are presented as numbered paragraphs.

The user writes only one skill objective for a given skill scale value within any given occupational-educational unit regardless of the variety of task contexts in which it is needed. When the same kind of activity appears in more than one task, a single content statement is given. This makes it possible to consolidate a good deal of task material when many tasks call for a skill to be manifested in the same way. The appropriate Task Code Numbers are listed after each numbered content statement.

There is one prototype for all the knowledge objectives. It first names the knowledge category and any relevant explanations of what is covered by the category. This is followed by numbered paragraphs which include the task language which indicates how the knowledge is applied. There is a closing paragraph which indicates the context for demonstrating mastery.

As in the case of the skill objectives, an objective for a knowledge category at a given scale value covers all the task activities that require the category at the value regardless of how different the activities are or how different the particular components of the subject area are. The language is consolidated across tasks. That is, when the same language appears in several tasks, one statement is written to cover it in the given knowledge objective. There are as many statements in a given knowledge objective as there are different descriptions of activities that require the knowledge in the given category at the scale value involved. These statements are also numbered, and each is followed by its Task Code Number references.

There is one procedural objective for each occupational-educational unit. No prototype is included in Appendix E, because the prototype simply presents a list of all the tasks of the unit and describes the intended learning outcomes with respect to the tasks as a whole. The prototype calls for the student to demonstrate knowledge of the proper sequence of events and contingencies associated with each task, proper use of all equipment not already covered by skill or knowledge objectives, and application of non-scalable knowledge, such as arithmetic when it is called for in conjunction with mathematical knowledge or symbolic skills. All the HSMS task descriptions or summaries for an occupational-educational unit are the references for procedural objectives; there is one procedural objective for each unit.

Thus, task descriptions become instructional materials; this places the evaluation of the student's mastery into a clinical setting or calls for clinical simulation.

Writing Curriculum Objectives

When HSMS staff write the curriculum objectives they work with one skill or knowledge category at a time. We start with the curriculum objectives for the lowest scale value of a skill or knowledge category and write all the objectives for that value, one for each occupational-educational unit that requires it. The next scale value is then done, and so on. By proceeding in this way we are able to pay attention to the additive nature of the curriculum objectives; we are able to use similar language for similar activities; and we are able to check any remaining discrepancies in the skill and knowledge scale data. We work first with the skills, then with the knowledge categories, and finally with the procedural objectives.

The user works with the annotated task descriptions and identifies all the annotated task language for a given skill or knowledge category at a given scale value for all the tasks listed for a given curriculum objective. If more than one section of a task is annotated, all are considered and represented. For a given curriculum objective, all task activities that use or are described in the same language are grouped, and one statement is written. Additional statements are written and numbered until all the tasks listed for the objective are represented in the content section of the objective.

The user should stay as much as possible with the language used in the task descriptions and attempt to present the content statements in such a way that the relevant context for each activity is apparent. The statements should mention the behavior required, may sometimes mention the standards, and need not indicate the substantive material that must be learned by the student in order to master the behavior. That is left to instructional planning.

The HSMS desiderata presented in Research Report No. 9 serve as educational objectives; the curriculum objectives provide a job-relevant set of learning outcomes; the curriculum outlines make it possible to plan educational ladders; and the task descriptions are usable as instructional materials. Together, these results of the research and analysis can become curriculum guidelines for the occupational programs covered in Research Reports 9 and 10.

CHAPTER 4

ANALYTIC PROCEDURES AND DETAILS

This chapter discusses the analytic procedures used in the HSMS method. The first section provides a general description of the procedures and computer programs.[1] The second and third sections provide a step by step presentation of how HSMS did the analysis in diagnostic radiography, radiation therapy, and ultrasound technology.

OVERVIEW

When all the tasks have been scaled for their skill and knowledge requirements, a raw data matrix is created in which the rows are the tasks, the columns are the skill and knowledge variables, and the entries are the scale values.[2]

The purpose of the analytic procedures is to go from this basic data matrix to recommendations on job ladders. The HSMS method groups a large number of tasks that require a large number of skill and knowledge categories (variables) at varying scale values into a meaningful smaller number of groupings in which the underlying association of skills and knowledges (variance) are reflected in the task groupings. From this grouping of variables and tasks we go to recommendations of job ladders. In its analysis HSMS makes use of a method of factor analysis called "principal components analysis" and a procedure we call "two-mode" factor analysis. We then use direct inspection and common sense to interpret the results of the two-mode factor analysis.

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[1] A more technical description of the HSMS analytic techniques and an independent scholars' review appear in Research Report No. 11, op. cit.

[2] In the more traditional uses of scaling data, such as in psychometrics, our "tasks" would be "individuals" or "subjects," and the skills and knowledges would be psychological or demographic variables.

The HSMS use of analytic techniques is descriptive; it is an applied use of statistics and not an attempt to build predictive models or to engage in pure research. Therefore, the techniques serve to organize and simplify the data; and the results are purely suggestive.

HSMS carries out the following analytic steps in order to proceed in its research objectives.

1. Selection of the tasks to enter the statistical analysis.
2. Selection of the variables that have sufficient frequency to enter into the factor analysis.
3. Use of principal component factor analysis to examine the structure of the variables. Selection of a solution (the number of factors) that best describes the relationship among variables.
4. Use of two-mode factor analysis to examine the structure of tasks based on the structure of variables. Assignment of each task to a factor.
5. Arrangement of tasks within factors by "point score" order of "difficulty" based on a count of all the skills and knowledges required for each task and the scale values at which each is required (including variables not part of the factor analysis).
6. Assignment of tasks to job levels within each factor based on "point scores."
7. Examination of the results and job ladder and lattice recommendations.

8. Preparation of the data for use in curriculum outlines, curriculum objectives and educational ladders to parallel the job ladders.

Selection of Skill and Knowledge Variables

In the HSMS method a program called EDIT is first used to help reduce the data to an acceptably sized raw data matrix for later factor analysis. By eliminating from the analysis skill or knowledge variables that appear with very low frequencies across tasks, we help to satisfy the statistical requirement that the number of observations (tasks) be significantly larger than the number of variables. This reduces the number of variables that take on a value of zero for most observations. The EDIT program also performs a logarithmic transformation on the data to bring them to a closer approximation of linearity among variables.[3]

In the HSMS computer programs we are limited to a maximum of 144 skill and knowledge variables. This results in good observation/variable proportions for our runs. For this report the basic factor analysis dealt with 88 variables. (Table 2 in Appendix A presents all the skill and knowledge variables originally found in the data base and indicates the variables that were retained for factor analysis.) There is now a reduced data matrix whose rows are the tasks selected for a given run and whose columns are the variables selected for that run; the entries are scale values adjusted by EDIT.

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[3] Eliminating variables with low frequency for factor analysis does not mean the loss of information about such variables. Later in the process when tasks are arranged in order of difficulty for assignment to job levels, and in the design of curricula, all the data enter into the analysis. At this stage, variables of low frequency do not provide information for grouping tasks, and their elimination is not a loss.

Factor Analysis

Classical factor analysis deals with statistical observations and variables. It examines the statistical relationship of every variable with every other variable, and groups these to best account for all the variability represented by the values of all the observations (tasks) on all the variables. A "factor solution" groups related variables into a given number of "factors." These account for the variance in a test space analogous to the way a regression line accounts for the correlation between two variables in two-dimensional space. The object is to replace the separate relationships of each variable with every other variable in a large number of variables with a smaller number of interrelated variable groups (factors). Each factor is essentially a construct that expresses the interrelationships within a particular group. The numerical "loading" of a given variable on a factor describes the extent to which the variations in the variable help determine the factor.

The HSMS method utilizes two factor analysis computer programs. The first is used to select the factors (groupings) that best describe the interrelationships among skill and knowledge variables. HSMS calls this "simple" factor analysis. The second program is used to obtain groupings among tasks that reflect the skill and knowledge groupings. HSMS calls this "two-mode" factor analysis.

The initial factor analysis program which provides the solution for grouping the variables has the name PCVARIM, an abbreviation for Principal Components Factor Analysis with Varimax Rotation.[4] The outputs of "simple" factor analysis are arrays, one for each factor "solution," in which the columns are the factors, the rows are the variables, and the entries are the numerical "loadings" of each variable on each factor. A "solution" is the number of factors into which the array is divided. The loadings reflect the extent to which a variable's scale value variations contribute to the variance accounted for by the factor in the given solution. There are as many solutions as the number of factors into which one desires to see the variance summarized.

Every variable has a loading on every factor. Variables can load on factors within the range of ± .99. Variables which are positively interrelated on a factor will have the same sign. The + or - has no other intrinsic meaning. A loading of ± .40 or more is of interest.

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[4] To arrive at principal axis (PA) factors, the PCVARIM program and the two-mode program use a principal components technique (unities rather than communality estimates in the diagonal), with a correlation matrix (rather than a covariance or cross-products matrix). A varimax rotation of the PA factors is used to produce an orthogonal (rather than oblique) factor solution.

The principal components technique (unlike other factor analytic techniques which first reduce the total variability in a test space) summarizes the total variability in a test space into a smaller number of orthogonal components. This choice of techniques summarizes the variance, it does not reduce it; it creates factors that are maximally independent of one another. The use of correlation matrices provides solutions that are not dependent on the standard deviations of the variables, as covariance matrices are, nor on the means and standard deviations, as cross-product matrices are.

In examining several factor solutions, such as ten-factors, nine-factors, and so on, down to three factors, one notes which variables have "high loadings" on a given factor in a given solution. These variables "determine" the factor, and their identities give some sense of the underlying meaning of the factor. In the case of HSMS data, a factor may suggest the skills and knowledge needed for a function, a specialization, a type of service, or a type of procedure.

The choice of an acceptable factor solution (that is, the choice of five factors rather than four or six factors) can be based on statistical criteria, on common sense, or on a combination of these.

HSMS first eliminates solutions that have factors with only three or fewer variables with relatively high loadings (i.e., ± .45 or more) and solutions in which no underlying structure of interest is evident. We narrow our choice to those solutions that make sense and on which most variables have a high loading on some factor, and in which few variables have high loadings on several factors. We look for stability of factor structures across several factor solutions and choose that solution whose underlying structure is most easily understood in terms of what we know about the nature of the work. (We discuss the factor solutions we selected later in this chapter.)

The two-mode factor program produces the "task factors." The number of task factors is determined by the number of variable factors in the solution just chosen. The output of the two-mode factor analysis is an array in which the columns are the factors and the rows are all the tasks. The factors correspond to their variable factor counterparts. The entries are the loadings of each task on every factor.[5]

The characteristic sign of the variable factor determines the sign of the task factor. Within this, a task's loading can be greater than an integer and can range anywhere down to zero, through zero, to still lower values of the opposite sign. (In reporting the results we use the convention of presenting high values as positive. The negative sign is used to represent loadings of less than zero.)

A task's loading on a factor reflects the skills and knowledge categories required for the task, the scale values at which they are required, and the loading of those particular variables on the corresponding variable factor. Skills and knowledges can have inverse (opposite sign) loadings on some factors, and these also influence a task's loading on factors. Thus, it is possible to examine a task's loading on all the factors and assign it to the factor on which it has its highest loading (within sign). A task loads highest on the factor with which the task has most in common in terms of skills and knowledges.

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[5] In the two-mode program the same reduced data matrix is used to form two conceptually different but necessarily related correlation matrices. One is the correlation of every variable with every other variable across all the tasks (as in simple factor analysis); the other is the correlation of every task with every other task across all the variables. The program produces the varimax representation of the principal components of the variable matrix as in the PCVARIM solution described earlier. The program also produces a transfer of the principal components of the task correlation matrix based on the Eckert-Young theorem. That is, the "variable mode" is rotated to simple structure and the "task mode" is "counter-rotated" by obtaining the transformed characteristic vectors of the observation mode induced by the varimax rotation of the variable mode.

Low-level tasks which require few skills or knowledge categories and at low scale values will have low loadings on all factors.[6] The difference in loadings for low-level tasks is so insignificant that a common-sense assignment of tasks to factors is often preferable to a mechanical statistical rule.

Assigning Tasks To Levels: Point Scores

The HSMS MATRIX program allows the user to examine tasks separately for each factor or in any grouping of interest. It presents the task data being examined in an array in which the tasks are arranged from left to right in any order selected. The tasks are the columns. The rows are all the skill and knowledge variables, listed from top to bottom in the order in which they appear in the tasks (which are arranged from left to right) including *all* the variables; the entries are the original scale values. Regardless of the order in which the tasks are arranged, by reading across a row one can see whether a given skill or knowledge category is required for any of the tasks, at what scale values, and for which tasks.

Within a factor some skills or knowledge categories are required at the same scale value for all tasks, and some are required at more than one scale value, depending on the tasks. We assign points to the tasks based on what is found in the array. For example, if a given variable appears for all but one task in a factor, say at 2.0, each task but that one receives a point. If a given variable appears for some tasks at 2.0, for others at 4.5, and for still others at 7.0, the tasks at 2.0 receive one point, those at 4.5 receive two points, and those at 7.0 receive three points. When this is done for all the variables and tasks in a factor or set of tasks, we add each task's points and list these at the bottom of the MATRIX array.

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[6] The loadings are not unlike factor scores with respect to their usefulness; unlike factor scores, tasks which have few variables above zero and low scale values do not take on spuriously high loadings on task factors.

The first MATRIX runs are generally entered by numerical order of the tasks' Code Numbers. If there is interest in comparing the point scores across factors, such as in the case of the three technologist factors, all such tasks are entered for a given MATRIX "run" and the resulting point scores are automatically comparable across all the tasks.

To assign tasks to job levels, the MATRIX program is then run for each factor with the tasks arranged from left to right in order of their point scores. The profile is now like that in Figure 5, which is a hypothetical presentation of a MATRIX array in which the tasks are arranged in ascending point score order based on point score analysis and assignment of tasks to levels.[7]

This ordering of the array produces a stepwise pattern because skills and knowledge categories that appear in low-level tasks continue to appear across the array and, as higher-level tasks are

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[7] The order of point scores roughly approximates the order of factor loadings, but differences are inevitable. This is because variables enter into the point scores that were not among those selected for the factor analysis; and variables with little variance would not have high factor loadings on the variable factors.

Figure 5. MODEL OF "MATRIX" ARRAY OF SKILLS AND KNOWLEDGES BY TASK AND JOB LEVEL

Skills and Knowledge Categories	FACTOR I LADDER								
	Level 1			Level 2			Level 3		
	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6	Task 7	Task 8	Task 9
Skill 1	1.0	1.0	2.0	2.0	2.0	4.0	4.0	9.0	9.0
* Skill 2	1.0	2.0	2.0	2.0	2.0	2.0	4.0	7.0	9.0
Skill 3		2.0	2.0	4.5		4.5	2.0	7.0	7.0
* Knowledge 1				1.5	1.5	1.5	7.0	1.5	7.0
Knowledge 2				3.5	3.5	2.5	5.5	2.5	9.0
Skill 4				5.0	5.0	5.0	5.0		5.0
Knowledge 3							5.0	6.0	
* Knowledge 4							3.5	9.0	9.0
Knowledge 5							8.5	8.5	8.5
Knowledge 6							3.5	7.5	7.5
Knowledge 7							7.0	7.0	9.0
Knowledge 8							7.0		8.5

* Asterisk denotes variables that determined the factor.

1. Tasks are listed from left to right in ascending order of loading on "task factor."
2. Skills and knowledge categories are listed from top to bottom in order of appearance in the task array.
3. Tasks are assigned to levels based on increasing numbers of skills and knowledges required and their scale values.
4. Not every skill or knowledge appears in all subsequent, higher-level tasks.
5. Scale values do not necessarily rise from level to level.
6. Scale values may vary within a level.

added, indented new arrays appear for skills and knowledge categories not required for lower-level tasks.

We mark off on each row the first task at which a scale value changes to a higher value, and continue across the row, marking the first appearance of still higher scale values. We examine the array to note at which position (task) large numbers of skill and knowledge categories are required for the first time, and where the scale values first rise. These step-like demarcation points help us to assess when we have a change of job level.

Often there is a dramatic point of change. In cases where the array shows no dramatic breaks we supplement our analysis by determining point score ranges for job levels and by examining the names of the tasks, using common sense to determine the difference between levels. The aim is to assign tasks to levels so that tasks with similar skill and knowledge requirements at similar scale values are assigned to the same job level.

Making Job Ladder Recommendations

The factor results do not necessarily guarantee that job ladders can be designed within factors. After tasks have been assigned to factors and levels it is possible to find only one level represented for a given factor. This was the case with our pilot test, in diagnostic radiology, and in the case of radiologic technology and ultrasound technology. For physician tasks the large number of skill and knowledge variables and the high scale values at which they are needed result in separate factors that do not relate to other factors. However, we were pleasantly surprised to find some genuine job ladder possibilities in the data included in all our applications of the method.

Some factors can appear above job levels 1 or 2 and be logical higher-level steps for the tasks in other factors. This happens when the higher-level factor combines the skill and knowledge requirements of one or more other factors. This is the basis of job lattices. We found this situation in our pilot test, in diagnostic radiology, and again in this report.

THE FACTOR STRUCTURE OF SKILL AND KNOWLEDGE VARIABLES

For this report, the first step in our analytic work was the selection of tasks for the analysis. We were interested in the interrelationships among the tasks at the technologist level and below, combining the tasks of Research Reports Nos. 7 and 9. Since all tasks dealing with teaching, research, and attendance at conferences were excluded for Research Report No. 9, we eliminated such tasks from the 368 tasks identified in diagnostic radiology.

We had decided to begin with two data bases; one included all the tasks in diagnostic radiology (excluding teaching, research, and conference tasks) and those in Research Report No. 9. The second excluded the radiologist tasks. We were interested in comparing the factor structures obtained with the radiologist tasks present with those obtained when we eliminated the large number of radiologist tasks with their numerous high-scaling skill and knowledge requirements. We were interested in determining whether the overall factor structures would be similar in the two instances. We also considered the possibility that, once the radiologist tasks were eliminated, technologist tasks might factor differently.

The original, more inclusive data base, covered 397 tasks; the more limited data base covered 296 tasks. The latter tasks are listed by Task Code Number and abbreviated task name in Appendix A, Table 1.

To carry out the factor analysis we eliminated enough low-frequency skill or knowledge variables in each data base to reach the maximum of 144 variables allowed by our factor programs. In the case of the 397 tasks, this was accomplished by eliminating all variables with frequencies of 7 or less and selectively deleting an additional 16 variables with frequencies of 8 or 9.

The data base of 296 tasks included far fewer variables because of the elimination of the radiologist tasks. As a result, the simple elimination of all variables with frequencies of 4 or less reduced the number of variables to 88. We considered that retaining variables with frequencies lower than 5 would distort the results as a consequence of having an undue number of zero scale values in the raw data matrix. Appendix A, Table 2 presents all the skill and knowledge variables associated with the 296-task data base.

We examined a series of factor "solutions" for each data base, from ten factors down to three factors inclusively. Each "solution" (number of factors) presents an array of loadings for each variable on each factor in the given solution. For each factor we noted every variable with a loading of ± .45 or higher and treated these variables as "determinants" of the given factor.[8] When we found a solution with more than three variables loading high on each factor, we considered the solution worth examining. We studied the composition of the variables to see the "sense" of the factors in the solution, and characterized or named the factor to reflect the content of the skills and knowledges involved.

The results were extremely gratifying because they not only repeated the results already obtained in diagnostic radiology, they were very similar across the two data bases. In the 296-task data base the physician-level factors remained relatively intact. We were impressed with the rather robust, stable nature of the factor structures obtained.

In the solutions for the 397-task data base which includes the radiologist tasks, the first four factors to appear were two radiologist factors, a radiologic technologist factor, and a patient care factor, all similar to those obtained in Research Report No. 8. The fifth factor to appear was an ultrasound factor. The sixth was a quality assurance factor also obtained in Research Report No. 8. Knowledge categories for radiation therapy "factored out" with radiologic technology (the third factor).

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[8] The co-variation of variables determines a factor. Variables with high loadings on a factor will tend to increase or decrease in scale value in an interrelated way across tasks. Tasks arranged in job ladders that reflect a skill and knowledge factor will tend to require increasing levels of the variables that determine the factor as one climbs the job ladder.

In the data base excluding the radiologist tasks, the first three factors to appear were a radiologic technology factor, a radiation therapy factor, and an ultrasound factor. The fourth factor to appear was a patient care factor based on categories under "Pharmacology"; the fifth factor was the quality assurance factor.

In the larger data base, the seven-factor solution rearranges the factors somewhat, so that the fifth factor is a gastrointestinal, obstetrics-gynecology factor, the sixth is quality assurance, and the seventh is an ultrasound technology factor. "Radiotherapy" appears in the first radiologist factor. The eight-factor solution provides separate obstetrics-gynecology and gastrointestinal factors; the nine-factor solution finally shows "radiotherapy" in its own factor, linked with variables that suggest mold room functions. The ten-factor solution provides a miscellaneous group as the tenth factor.

With the more limited data base, the six-factor solution combines mold room categories with categories related to the gastrointestinal system; it is somewhat unintelligible. The seven-factor solution separates the gastrointestinal-related factor from mold room categories. The eight-factor solution creates a general ultrasound factor and an obstetrics-gynecology ultrasound factor. The ninth and tenth factors in their respective solutions combine only two or three categories.

We selected the seven-factor solution for the larger data base and the five-factor solution for the more restricted data base. These solutions seemed to be most comparable, sensible, and stable, and sufficiently different to provide complementary information. The factor designations are compared in Figure 6, below:

Figure 6. COMPARISON OF FACTOR SOLUTIONS

397-Task Data Base		296-Task Data Base	
Factors	Percentage Variance	Factors	Percentage Variance
General radiology	38.5%	-	- %
Neuroradiology	11.1	-	-
Radiologic technology	10.9	Radiologic technology	19.7
Patient care	5.5	Patient care	6.5
GI,obs.-gyn. radiology	2.9	-	-
Quality assurance	2.5	Quality assurance	5.6
Ultrasound technology	2.9	Ultrasound technology	9.7
-	-	Radiation therapy technology	11.8
Total	74.3%	Total	53.3%

While the 397-task based solution accounts for more variance, most of this is covered by the two large radiologist factors. In the 296-task based solution the bulk of the variance is accounted for by the technologist functions; these are the prime focus of the analysis.

THE FACTOR STRUCTURE OF TASKS

The meaning of the factors becomes clearer when we examine how the tasks load on the factors. In order to follow the results, we present a brief review of what the task factors are; then the task content of the factors is described.

Interpreting the Two-Mode Task Factor Data

In the HSMS two-mode factor analysis method the selection of a skill-and-knowledge variable factor solution determines the number of factors and the nature of the factors to which tasks can be assigned.

To obtain task factors with the two-mode method we extract and rotate the number of factors chosen in the prior analysis of the factor structure of skill and knowledge variables. The task factors are then shown in an array in which the tasks are the rows and the factors are the columns. The entries are the tasks' numerical loadings on the factors. Each task has a loading on each factor. To interpret the data one must understand what a task factor represents, the meaning of the loadings, and how a task's loading on a factor arises.

Each task factor is a reflection of a corresponding variable factor in the factor solution previously chosen. For example, for the 397-task data base we chose a seven-factor solution; we got seven task factors. For the 296-task data base we chose a five-factor solution; we therefore got five task factors. The skill and knowledge variables that determine a variable factor determine how tasks will load on the corresponding task factor.

For any given task, the more skill and knowledge categories it requires of those variables that determine a given variable factor, the higher the task's loading will be on the corresponding task factor. The higher the task's scale values for those variables, the higher the task's loading on the factor. (The influence of each variable can be estimated by noting the variable's loading on the variable factor.) Since a task will have some numerical loading on all task factors, a given task can load low or negatively on factors that are determined by skill or knowledge categories not required for the task.[9]

Tasks with no knowledge categories, few skills, and low scale values will probably load negatively on all factors. Negative loadings are interpreted as less than zero in the usual numerical sense. For low-level tasks loadings are usually very similar on most factors, and are therefore somewhat ambiguous. When low-level tasks have such ambiguous loadings, HSMS assigns each to a factor which includes other tasks with similar point scores and with similar loadings in a context where the task makes sense. Generally we used the patient care (people-oriented) and quality assurance (materials-oriented) factors for such assignments.

Task Content of Factors

Once each task is assigned to the factor on which it has its highest loading, the task content of the factors emerge. At this point it became clear that the 397-task data base provided no information about the tasks in Research Report No. 9 that was not present in the 5-factor solution provided by the 296-task data base. All subsequent analysis was restricted to the data base including the 296 tasks. The following sections refer to data that are presented in the tables in Appendix B, which cover the 296 tasks.

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[9] The actual computer output shows factors with "characteristic signs." These carry over from the variable factor loadings to the corresponding task factors. For this report we converted negative-sign factors to their opposite sign because it is easier to interpret results that uniformly use negative loadings to mean loadings less than zero, for which the higher the negative figure the lower the loading.

The first factor is an exclusively radiologic technology factor. All the radiographic examinations load solely on this factor. The second factor includes most of the tasks found in radiation therapy excluding some tasks better associated with patient care and a few that load higher on the quality assurance factor (such as transporting sealed radioactive sources). The third factor includes almost all tasks found in ultrasound excluding some assigned to patient care or quality assurance. The fourth factor includes patient care tasks; we assigned low-level, people-oriented tasks to this factor. The fifth factor covers quality assurance and the activities associated with the physicist in diagnostic radiology; we assigned low-level materials-oriented tasks to this factor.

There were eight remaining administrative tasks. They were assigned to a non-factor grouping we call non-factor A: administration. Only one task was assigned to more than one factor: Task 280 covers personal radiation monitoring and is assigned to all but the ultrasound factor.

Assignment of Tasks To Job Levels

The hierarchy of tasks in a factor is the arrangement of tasks by order of difficulty so that tasks can be assigned to job levels. The MATRIX program is used for this purpose, as described earlier.

Factor loadings take account of the skill and knowledge variables that entered into the factor analysis; they do not reflect all the skill and knowledge requirements of tasks. For this purpose we do our "point analysis." In the point analysis, every skill or knowledge category required by a task and the scale values at which each is required enters into a "point score" for each task. This is an index of educational requirements, or "difficulty."

In the areas of radiologic technology, quality assurance, and patient care, benchmarks had already been established by the results of Research Report No. 8. The additional tasks on the latter two factors fell into place easily. In quality assurance we reassigned a small number of tasks from level 1 to level 2, so the results are somewhat different from Research Report No. 8.

The ultrasound factor contained only technologist-level tasks once the few patient care and quality assurance tasks were assigned to these other factors.

In the case of radiation therapy, even after the patient care and quality assurance tasks were assigned, there were tasks that were clearly below the technologist level. Most of these appear as level 2 technician tasks, primarily mold room, calculations, and assisting with procedures. A small number could be assigned to the aide level, but were clearly intimately related to the other technician tasks. Since they had point scores at the upper range of aide tasks, it seemed most sensible to group them at the technician level.

The administrative tasks of non-factor A were assigned to level 3 based on the way in which these tasks relate to other tasks. This group is likely never to become a separate job. It would be attached to jobs created from comparable levels in the other factors.

The tables in Appendix B present the tasks by descending order of their point scores. Tasks assigned by logic rather than loading are so indicated. Table 1 in Appendix A lists the tasks by Code Number and indicates their assignments to factors and to job levels.

APPENDIXES

A. Tasks Represented in Analysis: Factors and Job Levels Assigned to Tasks by Task Code and Abbreviated Task Name. A-1

B. Task Content of Jobs, Job Sequences and Task Factors. B-1

C. Health Services Mobility Study Scales. C-1

D. Skill and Knowledge Requirements and Curriculum Outlines. D-1

E. Examples of HSMS Curriculum Objectives. E-1

APPENDIX A

TASKS AND FACTOR STRUCTURES

Table 1. Tasks Represented in Analysis: Task Factors and Job Levels Assigned to Tasks by Task Code and Abbreviated Task Name. A-1

Table 2. Skills and Knowledges in Radiologic Technology, Ultrasound Technology, Radiation Therapy Technology and Related Functions: Factor Structure of Variables. A-23

Table 1

TASKS REPRESENTED IN ANALYSIS: TASK FACTORS AND JOB LEVELS ASSIGNED TO TASKS BY TASK CODE AND ABBREVIATED TASK NAME

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Task Code	Abbreviated Task Name	Task Factor[a]	Job Level[b]
8	Shutting down computerized transverse axial scanning equipment.	Q	1
18	Drawing blood from any non-pediatric patient's vein on orders.	P	2
19	Administering test for allergy to iodine based contrast medium of any patient.	P	4
33	Removing any patient's sutures.	P	2
65	Preparing specimens such as extravascular body fluids, washings, cell and/or tissue biopsies for transportation to laboratory.	P	2
69	Processing exposed x-ray film in automatic processor.	Q	1
70	Inspecting, cleaning and readying x-ray film hand processing equipment for use.	Q	1
71	Processing exposed x-ray film manually.	Q	1
72	Loading x-ray film cassette(s), nonscreen film holder(s), box(es), and/or roll film cartridges.	Q	1
73	Reassuring any patient and/or accompanying adult about x-ray and/or fluoroscopy procedures.	P	1
74	Explainning to any out-patient or accompanying adult proper at-home procedures to follow prior to coming for radiographic or fluoroscopic examination.	P	1
76	Checking supplies and ordering non-drug materials needed by department.	Q	1
77	Providing emergency care for any patient having adverse reaction to radiographic contrast medium, procedures, or accident.	P	4

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[a] Task factors are abbreviated as follows: D = diagnostic radiologic technology; R = radiation therapy technology; U = diagnostic ultrasound technology; Q = quality assurance and materials in radiology; P = patient care; A = administration.

[b] Job levels are as follows: 1 = aide; 2 = technician; 3 = technologist; 4 = jr. professional, supervisor-educator; 5 = professional.

Task Code	Abbreviated Task Name	Task Factor[a]	Job Level[b]
78	Checking and jacketing patient's radiographs, ultrasonograms and/or C.T.T. scans with requisition sheets and prior diagnostic materials and placing for filing or interpreting.	Q	2
79	Preparing barium sulfate contrast medium as ordered or for standard use.	Q	1
80	Preparing materials or trays with medications and materials for special treatments or procedures according to standard orders.	Q	1
81	Providing technical quality review of "plain film" radiographs.	D	3
95	Testing a urine sample by tablet or dipstick method and recording.	Q	1
98	Obtaining a clean catch urine specimen from any patient and preparing for laboratory.	P	1
113	Giving any patient general reassurance.	P	1
116	Deciding on and/or arranging for transportation for out-patient to and/or from treatment or examination.	P	1
124	Arranging to cover temporary or permanent staff shortages.	A	3
128	Checking supply of narcotics or regulated drugs (or witnessing count); reordering, picking up, and restocking.	Q	1
129	Checking supply and ordering non-narcotic medicinals needed by department.	Q	1
131	Making assignments of staff to work areas, procedures, and/or MD's and/or vacations and lunch hours.	A	3
132	Requesting repair, replacement or other services of another hospital department orally and/or filling out requisition.	A	3
133	Administering subcutaneous or intramuscular injection for any patient according to MD's orders after having quantity checked.	P	2*

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* Warrants being assigned to level 3, but there are not sufficient tasks at level 3 to justify a separate job at level 3 in patient care.

Task Code	Abbreviated Task Name	Task Factor[a]	Job Level[b]
134	Logging and/or tallying patient services and/or instructional case record materials for use in record keeping, billing or instruction.	Q	1
135	Cleaning an examination or treatment room after use.	Q	1
136	Checking and storing order for non-narcotic drugs and/or supplies.	Q	1
137	Delivering prepared specimens or cultures to lab or incubator.	Q	1
138	Reporting observed symptoms and concerns of any patient to physician or staff member.	P	1
143	Catheterizing any female urethra as ordered.	P	2
145	Preparing treatment or examination equipment for sterilization in autoclave.	Q	1
147	Preparing or changing technique charts for specific x-ray and fluoroscopic equipment on orders.	Q	2
151	Preparing treatment or examination room(s) for use.	Q	1
153	Assisting physician or co-worker in special examination or treatment procedures.	P	1
155	Obtaining urine specimen on orders.	P	1
156	Irrigating, cleaning, dressing or redressing any patient's wound, burn, or opening for catheter as ordered.	P	2
159	Checking reason for non-appearance of out-patient for examination or treatment and arranging for rescheduling.	P	2
163	Filling out institutional report form (such as for cancellation) as ordered by MD.	Q	1
164	Filling out patient identification information on labels and forms in anticipation of need or as requested.	Q	1
165	Keeping attendance records and recording or reporting excessive lateness and/or absenteeism.	A	3

Table 1 (continued) p. 4 of 21

Task Code	Abbreviated Task Name	Task Factor[a]	Job Level[b]
166	Using isolation and decontamination techniques to prepare examination or treatment room or area and clean up afterwards for patient with infectious or communicable condition.	P	1
167	Inspecting and cleaning intensifying screens in cassette holders.	Q	1
173	Checking accuracy of x-ray machine timers (except phototimers) with spinning top test.	Q	2
175	Performing penetrometer calibration test of kVp or mA selectors of x-ray machine output.	Q	2
178	Checking, preparing fluoroscope controls (and phototimer).	Q	2
180	Preparing blood samples for the laboratory.	Q	1
181	Catheterizing any male or female patient's urethra with retention balloon catheter.	P	2
182	Setting up and using suction machine to clear airway or to assist with gastric lavage.	P	2
184	Relocking equipment box(es) with breakaway lock.	Q	1
185	Administering oxygen from portable or piped outlet unit using oronasal or nasal mask according to MD's orders.	P	2
186	Orienting new staff member(s) to departmental standard operating and administrative procedures, floor plan, location of equipment and supplies, record keeping.	A	3
187	Checking cassettes for proper film-screen contact.	Q	2
190	Assisting patient to or from wheelchair, stretcher, bed, or table and/or transporting patient to designated area.	P	1
192	Inspecting, checking, preparing xeroradiography equipment for use.	Q	1
193	Having any patient and materials prepared for special procedure and readying patient for examination.	P	1

Table 1 (continued) p. 5 of 21

Task Code	Abbreviated Task Name	Task Factor[a]	Job Level[b]
194	Administering eye or ear drops to any patient on orders.	P	2
195	Applying an eye patch for any patient on orders.	P	1
198	Administering medication orally to any patient according to MD's orders after having quantity checked.	P	2
199	Taking and recording vital signs (temperature, pulse, respiration and blood pressure) of any patient.	P	1
222	Making photocopies of documents, collating, and stapling.	Q	1
223	Making up unoccupied bed or stretcher bed.	Q	1
227	Checking for presence and condition of emergency supplies in proper locations; and restocking as needed.	Q	1
243	Restraining any patient.	P	2
260	Preparing a hypodermic needle with injection dosage on orders.	Q	1
262	Taking an electrocardiogram of any patient as ordered or determined.	P	1
264	Ordering duplicate copies of forms, records, or documents.	Q	1
265	Filing or obtaining records from files by patient identification number and/or name.	Q	1
267	Processing exposed Polaroid x-ray film with Polaroid automatic processing equipment.	Q	1
269	Loading empty cassette with Polaroid x-ray film.	Q	1
271	Deciding whether to call staff person to evaluate whether unusual ECG reading is artifact, or calling physician in case of serious patient distress.	P	1
272	Preparing and adjusting schedules for patient procedures.	A	3
273	Cleaning, inspecting and readying automatic x-ray film processor(s) for use.	Q	1

Table 1 (continued) p. 6 of 21

Task Code	Abbreviated Task Name	Task Factor[a]	Job Level[b]
274	Adding predetermined instruments and supplies to prepared procedure trays.	Q	1
275	Preparing radiographic subtraction prints.	Q	1
276	Making minor adjustments or repair on automatic x-ray film processor.	Q	2
277	Assigning scheduled patients to procedure rooms in appropriate order.	A	3
278	Checking on reasons for nonappearance of in-patients for examinations or treatments.	P	1
279	Notifying ward or floor personnel to ready and transport in-patients who are scheduled for specific procedures at specific times.	P	1
280*	Participating in monitoring of personal exposure to radiation by periodically turning in and replacing film strip in badge worn by performer.	P D R R Q	2 3 2 3 2
281	Checking in-patients' identity against patients' treatment and medication check lists; stamping arrival and departure times; attaching cards to patients indicating special conditions.	P	1
282	Escorting adult out-patients to and/or from dressing rooms, treatment rooms and/or waiting areas.	P	1
283	On orders, deciding whether wound of any patient needing change of dressing needs attention of RN; changing dry dressing or reinforcing wet dressing.	P	1
284	Checking presence and functioning of oxygen or suction equipment, and amounts of oxygen.	Q	1
285	Checking for presence of emergency supplies in proper locations.	Q	1
286	Filling out standard order for linen; picking up, folding and storing.	Q	1
287	On orders, placing order for specific dietetic meal; picking up, delivering, and feeding patient if so decided.	P	1

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* Task 280 appears in four factors and two levels since it involves monitoring of performer's exposure to ionizing radiation.

Task Code	Abbreviated Task Name	Task Factor[a]	Job Level[b]
288	Filling out and delivering standard order for food items for department; picking up, and placing food for storage.	Q	1
289	Bottle feeding a baby with pre-prepared formula.	P	1
290	Changing any patient's colostomy bag on orders.	P	1
291	Taking and reporting temperature of any non-pediatric patient with oral thermometer on orders.	P	1
292	Obtaining and examining fresh stool from any patient and reporting unusual or suspicious appearance, on orders.	P	1
294	Assigning subordinate and explaining assignment to transport patient, obtain materials or documents, or assist co-worker.	A	3
296	Providing first aid in x-ray department emergency.	P	2*
297	Obtaining and checking keypunch control card for serial cassette changer as ordered.	Q	1
298	Administering medication orally to any patient according to MD's orders.	P	2
299	Administering subcutaneous or intramuscular injection for any patient according to MD's orders.	P	2*
300	Checking and submitting accumulated patients' treatment and medication check lists for in and out time stamps.	Q	1
301	Diapering a baby.	P	1
302	Placing or making call and delivering non-medical message at patient's or co-worker's request.	P	1
303	Arranging, measuring and recording food intake and excretory output as ordered.	P	1
304	Readying emergency cart.	Q	2

* Warrants being assigned to level 3, but there are not sufficient tasks at level 3 to justify a separate job at level 3 in patient care.

Table 1 (continued)

Task Code	Abbreviated Task Name	Task Factor[a]	Job Level[b]
308	Setting up and monitoring any patient's electrocardiogram during special procedure.	P	2
319	Applying print coater to photographs.	Q	1
354	Obtaining patient records for use in examination, procedure, treatment or conference.	Q	1
355	Taking plain film radiographs of fingers, hand(s), or wrists of non-infant patient.	D	3
356	Taking plain film radiographs of forearm and/or elbow joint of non-infant patient.	D	3
357	Taking plain film radiographs of humerus and/or shoulder girdle of non-infant patient.	D	3
358	Taking plain film radiographs of toes, foot and/or ankle joint of non-pediatric patient.	D	3
359	Taking plain film radiographs of leg(s), knee(s) and/or femur(s) of non-infant patient.	D	3
360	Taking plain film radiographs of pelvis, hips and/or upper femora of non-infant patient.	D	3
361	Taking plain film radiographs of vertebral column of non-infant patient.	D	3
362	Taking plain film radiographs of sternum, ribs and/or thoracic viscera of non-infant patient.	D	3
363	Taking plain film radiographs of abdominal contents of non-infant patient.	D	3
364	Taking radiographs of anterior portion of the neck of non-infant patient.	D	3
365	Taking plain film radiographs of the skull and/or face of non-infant patient.	D	3
366	Taking plain film radiographs of the paranasal sinuses of a non-infant patient.	D	3
367	Taking preliminary localization radiographs of foreign bodies in orbit or eye of non-infant patient.	D	3

Task Code	Abbreviated Task Name	Task Fac- tor[a]	Job Level[b]
368	Taking mammograms (radiography or xeroradiography) of non-infant patient.	D	3
369	Preparing, transporting, setting up and returning mobile portable radiography equipment for bedside radiography.	D	3
370	Taking operative orthopedic radiographs of any patient (such as in hip pinning).	D	3
371	Taking operative cholangiograms, pancreatograms or similar operative radiographs of any patient.	D	3
372	Taking intravisceral or isolated operating room radiographs of any patient.	D	3
373	Taking operating room radiographs for opaque foreign body search.	D	3
374	Taking tomograms of non-infant patient.	D	3
375	Taking sialograms of any patient.	D	3
376	Taking lymphangiograms of lymphadenograms of any patient.	D	3
377	Taking positive contrast arthrograms (especially of knee) of any patient.	D	3
378	Taking bronchograms of a non-pediatric patient.	D	3
379	Carrying out radiologic technology for bronchoscopy or needle lung biopsy of a non-pediatric patient.	D	3
380	Providing technical assistance for laryngography or cleft palate study of any patient (or any similar fluoroscopic examination including spot filming and/or cineradiography).	D	3
381	Taking upper GI radiographs of non-pediatric patient.	D	3
382	Taking small intestine intubation radiographs of a non-pediatric patient.	D	3
383	Taking barium enema radiographs of non-pediatric patient.	D	3

Task Code	Abbreviated Task Name	Task Factor[a]	Job Level[b]
384	Taking oral cholecystograms and cholangiograms of non-infant patient.	D	3
385	Taking intravenous cholangiograms and cholecystograms of non-infant patient.	D	3
386	Taking percutaneous or T-tube cholangiograms of non-infant patient.	D	3
387	Taking intravenous pyelograms and urograms of non-pediatric patient.	D	3
388	Taking infusion nephrotomograms of any patient.	D	3
389	Taking percutaneous antegrade or renal cyst pyelograms of non-infant patient.	D	3
390	Taking cystograms and voiding cystourethrograms of any patient.	D	3
463	Taking retrograde pyelograms and ureterograms of non-pediatric patient.	D	3
464	Providing technical assistance for an examination of any patient requiring fluoroscopic control and spot filming.	D	3
465	Taking pelvic pneumograms and/or hysterosalpingograms of non-pediatric female patient.	D	3
466	Taking radiographs of a pregnant patient's abdomen for fetography, amniography, placentography.	D	3
467	Taking radiographs of a pregnant patient's uterus for intrauterine transfusion.	D	3
468	Taking radiographs of a pregnant patient's pelvis for Colcher-Sussman pelvimetry.	D	3
490	Mummying or wrapping an infant or young pediatric patient.	P	1
491	Taking plain film radiographs of the skull of an infant patient.	D	3

Table 1 (continued) p. 11 of 21

Task Code	Abbreviated Task Name	Task Factor[a]	Job Level[b]
492	Taking plain film radiographs of vertebral column of infant patient.	D	3
493	Taking plain film radiographs of the upper extremities of infant patient.	D	3
494	Taking radiographs of neck, chest of infant patient.	D	3
495	Taking plain film radiographs of abdomen of infant patient.	D	3
496	Taking plain film radiographs of the lower extremities of infant or pediatric patient.	D	3
497	Taking radiographs for choanal atresia study of infant patient.	D	3
498	Taking bronchograms of a pediatric patient.	D	3
499	Taking upper GI radiographs of pediatric patient.	D	3
500	Taking barium enema, intussusception or defecography radiographs of pediatric patient.	D	3
501	Taking percutaneous peritoneograms/herniograms of pediatric patient.	D	3
502	Taking excretory intravenous inferior vena cavograms and urograms of pediatric patient.	D	3
503	Taking genitograms or fistulograms of any patient for intersex, external fistula or sinus tract examination.	D	3
504	Taking cerebral angiograms or venograms of any patient.	D	3
505	Taking pneumoencephalograms or brain ventriculograms of any patient.	D	3
506	Taking positive contrast spinal or posterior fossa myelograms of any patient.	D	3
507	Taking diskograms of any patient.	D	3
508	Taking air or gas contrast myelograms of any patient.	D	3
509	Taking spinal cord angiograms of any patient.	D	3

Task Code	Abbreviated Task Name	Task Fac-tor[a]	Job Level[b]
510	Taking peripheral angiograms of any patient (after percutaneous needle or catheter entry, translumbar puncture, ascending or descending venous entry).	D	3
511	Taking catheter thoracic and/or abdominal aortograms of any patient, and/or selective visceral arteriograms (bronchial or abdominal).	D	3
512	Taking selective pelvic angiograms of non-pediatric gravid or nongravid female patient.	D	3
513	Taking intravenous angiocardiograms of any patient.	D	3
514	Taking selective thyroid angiograms of any patient.	D	3
515	Taking catheter inferior vena cavograms and/or renal or adrenal venograms of non-infant patient.	D	3
516	Taking percutaneous splenoportograms of any patient.	D	3
517	Taking selective subclavian arteriograms of non-pediatric patient for thoracic outlet syndrome evaluation.	D	3
518	Taking selective pulmonary angiograms or selective angiocardiograms of any patient.	D	3
519	Taking percutaneous coronary arteriograms and/or left ventriculograms of any patient.	D	3
520	Preparing any patient and attaching electrodes for electrocardiogram monitoring.	P	1
521	Applying digital or manual pressure to any patient's arterial or venous puncture site as ordered.	P	1
522	Applying pressure dressing to arterial or venous puncture site.	P	2
523	Preparing computerized transverse axial tomography (C.T.T.) equipment for use.	Q	2
524	Providing preventive maintenance for display tube surface, camera, disc and/or tape drive units, and/or scanning assembly (especially water-using head box assembly) of computerized transverse axial tomography (C.T.T.) equipment.	Q	2

Task Code	Abbreviated Task Name	Task Factor[a]	Job Level[b]
525	Checking calibration and accuracy of C.T.T. equipment by making test scans.	Q	2
526	Taking computerized transverse axial tomographic (C.T.T.) scans of any patient.	D	3
527	Retrieving, displaying and making photographs, printouts and/or magnetic tape records of computerized transverse axial tomographic (C.T.T.) scans.	Q	2
528	Designing, maintaining, evaluating calibration and/or dose monitoring program in diagnostic radiology.	Q	5
529	Checking x-ray field limitation, x-ray receptor and light field alignment, minimum TOD, TFD and field size indicators for diagnostic x-ray equipment.	Q	2
530	Checking fluoroscopic and spot film x-ray field limitation, x-ray field and image receptor alignment, maximum TID, minimum TOD, and other requirements.	Q	2
531	Testing whether diagnostic x-ray tube overload protection and/or effective focal spot size meet acceptable standards.	Q	2
532	Checking and/or performing direct calibration tests of diagnostic radiography equipment exposure timers.	Q	2
533	Checking automatic exposure termination of diagnostic radiography equipment.	Q	2
534	Providing visual and radiographic or fluoroscopic inspection of personnel shielding devices such as leaded gloves, aprons, sheets, gonadal shields.	Q	2
535	Performing calibration tests of kVp, mA, mAs, exposure rates, reproducibility on diagnostic radiography equipment using direct measuring instruments and/or radiographic comparisons.	Q	2
536	Providing visual and/or manual inspection of diagnostic radiography system.	Q	2
537	Checking diagnostic tomography x-ray equipment for operation, fulcrum position, resolution, exposure uniformity and/or grid alignment.	Q	2

Table 1 (continued)

Task Code	Abbreviated Task Name	Task Factor[a]	Job Level[b]
538	Estimating HVL and checking adequacy of filtration of diagnostic x-ray equipment.	Q	2
539	Checking bucky grid alignment and/or centering in diagnostic radiography equipment.	Q	2
540	Checking fluoroscopic automatic brightness control system and/or focus, resolution and distortion of the optical system.	Q	2
541	Evaluating accepted and rejected radiographs to identify any technical problems with staff functioning, equipment, radiation protection.	Q	5
542	Designing, maintaining, evaluating darkroom and/or film processor monitoring program in diagnostic radiology.	Q	5
543	Monitoring and evaluating x-ray film processors.	Q	2
544	Determining exposure characteristics of x-ray and/or dosimetric films.	Q	2
545	Monitoring patient exposure rates for routine diagnostic x-ray procedures.	Q	2
546	Designing, maintaining, evaluating radiation protection and monitoring programs in diagnostic radiology.	Q	5
547	Determining primary and secondary structural shielding required for diagnostic x-ray installations.	Q	5
548	Checking maximum entrance exposure rate and primary barrier transmitted radiation rate for fluoroscopic equipment.	Q	2
549	Checking the leakage radiation rate from the source assembly of diagnostic x-ray equipment.	Q	2
550	Conducting protection survey of stray radiation within diagnostic x-ray installation and transmission across primary and secondary protective barriers.	Q	2
551	Preparing personnel radiation monitoring dosimetric film or TLD badges and distributing.	Q	1
552	Collecting and/or distributing personnel monitoring dosimetric badge inserts and preparing for outside or in-house processing and reading.	Q	1

Task Code	Abbreviated Task Name	Task Factor[a]	Job Level[b]
553	Reading and recording exposure from personnel monitoring film or thermoluminescent dosimeters.	Q	2
554	Entering, evaluating occupational radiation exposure data and initiating action on dangerous levels.	Q	2
555	Investigating reasons for reported high occupational radiation exposure and initiating remediation.	Q	5
556	Calibrating diagnostic x-ray test, survey, or measuring instruments.	Q	2
557	Collecting and presenting technical information about and/or recommending new diagnostic x-ray equipment.	Q	5
561	Planning and arranging for pre-treatment procedures for external beam radiation therapy.	R	3
562	Participating in discussion on, or answering questions about, external beam radiation therapy equipment in relation to proposed treatment plan.	R	3
563	Carrying out simulation and/or initial set-up for any patient to receive external beam radiation therapy of the head, neck, and/or spinal column, using simulator or treatment machine.	R	3
564	Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the thorax, such as lungs, pleura, esophagus, mediastinum, using simulator or treatment machine.	R	3
565	Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the breast(s), using simulator or treatment machine.	R	3
566	Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the lymph nodes with mantle and/or "inverted-Y" field techniques or variations, using simulator or treatment machine.	R	3
567	Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the whole abdomen, or female patient to receive external beam radiation of the reproductive system, using simulator or treatment machine.	R	3

Task Code	Abbreviated Task Name	Task Factor[a]	Job Level[b]
568	Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the whole pelvis, urinary bladder, or male patient to receive external beam radiation of the prostate, using simulator or treatment machine.	R	3
569	Carrying out simulation and initial set-up for male patient to receive external beam radiation therapy of the testis, using simulator or treatment machine.	R	3
570	Carrying out simulation and initial set-up for male patient to receive external beam radiation therapy of the penis, using simulator or treatment machine.	R	3
571	Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the kidney and/or adrenal glands or neuroblastoma, using simulator or treatment machine.	R	3
572	Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the bone and/or soft tissue of an extremity, using simulator or treatment machine.	R	3
573	Carrying out simulation and/or initial set-up for any any patient to receive external beam radiation therapy of the whole body.	R	3
574	Preparing a contour drawing at the appropriate treatment level(s) of any patient to receive external beam radiation therapy.	R	2
575	Taking transverse axial tomograms of any patient.	R	3
576	Assisting as ordered with localization, simulation and/or initial set-up procedures for any patient to receive external beam radiation therapy, using simulator or treatment machine as ordered.	R	2
577	Applying lead contact or spatula-type internal eye shield under any radiotherapy patient's eyelid.	P	2
578	Inserting radiopaque probe into female patient's vagina to localize tumor or cervix.	P	2

Task Code	Abbreviated Task Name	Task Factor[a]	Job Level[b]
579	Inserting balloon catheter or barium enema in any patient's rectum to localize tumor or rectum.	P	2
580	Taking photograph(s) of any patient's face and/or treatment areas as ordered.	R	2
581	Discussing, planning and arranging for mold room procedures to fabricate treatment devices such as shells, casts, masks, applicators, beam blocks, bolus, shields, etc., for use in radiation therapy.	R	3
582	Fabricating a treatment shell or mask of plaster of Paris bandages using direct technique for radiotherapy patient.	R	3
583	Fabricating a treatment mold or applicator or solid cast for radiotherapy patient from dental impression compound, and/or plaster of Paris, or liquid resin acrylic, or stone plaster, using indirect technique.	R	3
584	Preparing an intracavitary or surface applicator mold to receive radioactive sealed sources.	R	2
585	Preparing a solid cast of plaster of Paris or stone plaster for use as model in treatment planning or for shaping lead shields.	R	2
586	Forming a plastic radiotherapy treatment shell from a solid or positive cast of plaster of Paris or stone plaster, using a vacuum forming machine.	R	2
587	Making an intraoral or surface stent or dental wax cast impression of a radiotherapy patient.	R	2
588	Fabricating a bite-block or other radiotherapy treatment mold from a wax cast.	R	2
589	Preparing a lead bite-block or other lead block for radiotherapy use from a wax cast set in plaster mold.	R	2
590	Applying a wax bolus to a radiotherapy treatment shell.	R	2
591	Fabricating lead shielding for radiotherapy treatment fields.	R	2

Task Code	Abbreviated Task Name	Task Fac-tor[a]	Job Level[b]
592	Fabricating and shaping radiotherapy lead shielding or mask cutouts on a plaster cast of radiotherapy patient.	R	2
593	Cutting treatment portals out of radiotherapy treatment shell.	R	2
594	Fabricating a contact or spatula-type internal eye shield for radiotherapy.	R	2
595	Fitting a radiotherapy treatment shell to a patient, fixing to supports and/or attaching straps.	R	2
596	Preparing and/or arranging external beam radiotherapy beam blocks or compensating filters of prescribed shape and HVL for use in shadow tray.	R	2
597	Fabricating radiotherapy styrofoam molds for beam blocking using marked radiograph, treatment geometry and a hot wire cutting device.	R	2
598	Fabricating customized lead radiotherapy shielding beam blocks with styrofoam molds.	R	2
599	Setting up any radiotherapy patient and administering external beam radiation therapy to the head and/or neck and/or spinal column.	R	3
600	Setting up any radiotherapy patient and administering external beam radiation therapy to the thorax, for treatment of lungs, pleura, esophagus, or mediastinum.	R	3
601	Setting up any radiotherapy patient and administering external beam radiation therapy to the breast(s).	R	3
602	Setting up any radiotherapy patient and administering external beam radiation therapy to the lymph nodes with mantle and/or "inverted-Y" field techniques or variations.	R	3
603	Setting up and administering external beam radiation therapy to whole abdomen of radiotherapy patient or female patient to receive external beam radiation of the reproductive system.	R	3

Task Code	Abbreviated Task Name	Task Factor[a]	Job Level[b]
604	Setting up and administering external beam radiation therapy to the whole pelvis or urinary bladder of a radiotherapy patient or male patient to recieve external radiation of the prostate.	R	3
605	Setting up a male radiotherapy patient and administering external beam radiation therapy to the testis.	R	3
606	Setting up a male radiotherapy patient and administering external beam radiation therapy to the penis.	R	3
607	Setting up any radiotherapy patient and administering external beam radiation therapy to the kidney and/or adrenal glands.	R	3
608	Setting up any radiotherapy patient and administering external beam radiation therapy to the bone and/or soft tissue of an extremity.	R	3
609	Setting up any radiotherapy patient and administering external beam radiation therapy to the whole body.	R	3
610	Reassuring any radiotherapy patient and/or accompanying family member about external beam radiotherapy procedures.	P	2
611	Explaining to any out-patient or accompanying family member proper at-home procedures to follow prior to coming for radiation therapy treatment.	P	1
612	Preparing external beam treatment equipment with appropriate attachments.	R	2
613	Calculating and recording or checking and reporting errors in calculations in external beam radiation treatment plan or in therapy chart, such as effective area, dose time or monitor units, central axis depth dose, prescribed total tumor dose versus total given dose, according to pre-determined formulae, using appropriate information.	R	2
614	Adding and recording accumulated given doses and/or weekly final tumor doses, or checking and reporting calculation errors, in radiotherapy treatment charts.	R	2
615	Planning and arranging procedures for intracavitary or interstitial radiation therapy (brachytherapy).	R	3

Task Code	Abbreviated Task Name	Task Factor[a]	Job Level[b]
616	Reassuring any radiotherapy patient and/or accompanying family member about intracavitary, or interstitial implant, or instillation, or remote afterloader procedures.	P	2
617	Calculating treatment time for remote afterloader intracavitary radiation treatment or checking calculation.	R	2
618	Reinforcing or informing internal radiation therapy patient about expected reactions to therapy, self care, and danger signs to report.	P	2
619	Taking localization films of intracavitary applicator or interstitial implant prior to treatment of a radiation therapy patient.	R	3
620	Assisting radiotherapist in application and/or removal of intracavitary applicator for remote or conventional afterloader radiation treatment of any patient.	P	2
621	Transporting sealed radioactive isotopes within institution from storage to treatment area safes following appropriate safety precautions.	Q	2
622	Taking localization radiographs and administering intracavitary radiation therapy with remote afterloader to any internal radiation therapy patient.	R	3
623	Making B-scan ultrasonograms of a pregnant patient and fetus.	U	3
624	Making B-scan ultrasonograms of a female patient's pelvis to study reproductive organs, pelvic masses.	U	3
625	Making B-scan ultrasonograms of any patient's abdominal contents, such as liver, gallbladder, pancreas, and/or spleen.	U	3
626	Making B-scan ultrasonograms of any patient's kidney(s).	U	3
627	Making B-scan ultrasonograms of any patient's thoracic contents to study mediastinal masses, pulmonary emboli, pleural lesions, and/or pleural effusion.	U	3

Task Code	Abbreviated Task Name	Task Factor[a]	Job Level[b]
628	Making B-scan ultrasonograms of superficial mass(es) of any patient.	U	3
629	Making B-scan ultrasonograms of any patient to differentiate free fluid from fixed fluid, such as in ascites.	U	3
630	Making A-mode echoencephalograms of any patient.	U	3
631	Making A-mode and B-mode scan ultrasonograms of a fetal skull in utero.	U	3
632	Loading camera for photography of oscilloscope display; making exposures on orders; recording patient identification, date, series number, level and directional reference.	Q	1
633	Reassuring any patient and/or accompanying adult about diagnostic ultrasound procedures and/or explaining prior fluid intake if appropriate.	P	1
634	Making B-mode scan and A-mode ultrasonograms of any patient's abdominal aorta.	U	3
635	Making M-mode echocardiograms of the heart and pericardium of any patient.	U	3
636	Making B-scan, A-mode and M-mode ultrasonograms of the fetal heart in utero for calculation of fetal heart rate.	U	3
637	Using Doppler ultrasonic motion detector to detect or monitor the fetal heart in utero.	U	3
638	Using Doppler ultrasonic motion detector to evaluate blood flow, pressure, occlusion in neonate or any patient.	U	3
639	Carrying out standard tests and calibration checks of diagnostic ultrasound equipment.	Q	2

Total Tasks: 296

Total D Tasks:	74.*	Total Q Tasks:	88.*
Total R Tasks:	54.*	Total P Tasks:	61.*
Total U Tasks:	14.	Total A Tasks:	8.

* Includes Task 280.

Note: Task descriptions appear in Research Report No. 7, Volumes 2 and 3, and Research Report No. 9.

Table 2. SKILLS AND KNOWLEDGES IN RADIOLOGIC TECHNOLOGY, ULTRASOUND TECHNOLOGY, RADIATION THERAPY TECHNOLOGY AND RELATED FUNCTIONS[a]: FACTOR STRUCTURE OF VARIABLES p. 1 of 5

Skill, or Knowledge Category Number and Abbreviated Name[b]	Factor Loadings[c] Rad. Tech.	Ultrasd. Tech.	Radther. Tech.	Qual.Ass. Materials	Patient Care
Object Manipulation Skills	.43				
Guiding or Steering Skills	.57	.64			
Human Interaction Skills	.60				
Leadership Skills					
Oral Use of a Relevant Language	.62				
Reading Use of a Relevant Language	.61			.41	
Written Use of a Relevant Language	.47	.41		.51	
Decision Making on Methods	.40			.50	
Decision Making on Quality					
Figural Skills	.73				
Symbolic Skills	.64			.54	
Taxonomic Skills	.76				
Implicative Skills	.65	.41			
Financial Consequences of Error				.61	
Consequences of Error to Humans	.67				
11731000 Normal structure and function	.43	.42	.56		
11731100 Regional anatomy	.77				
11731200 Topographic anatomy	.80				
11731300 Hematopoietic system[d]					
11731400 Circulatory system					

[a] Refers to analysis of 296 tasks listed in Table 1 by abbreviated task names, and 127 skill and knowledge variables; 88 variables were included in factor analysis. See (d), below.

[b] See Table 9, Appendix D, for full names of knowledge categories and Appendix C for skill scales.

[c] Loadings of ± .40 or more are shown; blanks indicate lower loadings.

[d] Indicates category not included in factor analysis because frequency across tasks is less than 5.

Table 2. (continued)

p. 2 of 5

Knowledge Category Number and Abbreviated Name[b]		Factor Loadings[c]				
		Rad. Tech.	Ultrasd. Tech.	Radther. Tech.	Qual.Ass. Materials	Patient Care
11731500	Respiratory system					
11731600	Digestive system					
11731610	Mouth, pharynx, esophagus					
11731620	Stomach and small intestine					
11731630	Large intestine (colon) and rectum					
11731640	Liver, biliary system, and pancreas					
11731700	Urinary system		.42			
11731800	Musculoskeletal system	.82				
11731810	Muscles			.42		
11731820	Bones and joints	.87				
11731831	Skin and sweat glands[d]					
11731910	Central nervous system					
11731943	Eye and optic nerve					
11731945	The ear[d]					
11732100	Immunologic system[d]					
11732210	Endocrine glands and hormone physiology			.49		
11732221	Conception and contraception[d]					
11732222	Male reproductive system			.42		
11732223	Female reproductive system		.55			
11732300	Honeostasis of fluids[d]					
11733100	Infective and parasitic diseases[d]					
11733200	Neoplasms (cancerous growths)	.41		.73		
11733300	Endocrine, nutritional, metabolic disorders[d]					
11733400	Disorders of blood, blood-forming organs[d]					
11733510	Disorders of central nervous system					
11733600	Disorders of the circulatory system	.80				
11733700	Disorders of the digestive system					
11733800	Disorders of the respiratory system	.86				
11733900	Disorders of the uro-genital system					

Table 2. (continued) p. 3 of 5

Knowledge Category Number and Abbreviated Name[b]		Factor Loadings[c]				
		Rad. Tech.	Ultrasd. Tech.	Radther. Tech.	Qual.Ass. Materials	Patient Care
11734100	Disorders of skin, subcutaneous tissues					
11734200	Disorders of musculoskeletal system	.90				
11734300	Congenital abnormalities		.64			
11734400	Disorders, complications of pregnancy, birth		.72			
11734500	Perinatal morbidity and mortality		.76			
11734600	Burns[d]					
11734800	Shock and trauma	.89				
11735000	Surgery			.91		
11735100	Operative procedures			.81		
11735300	Repair surgery[d]					
11735400	Introductory procedures	.42		.45		
11735500	Endoscopy[d]					
11735600	Suture[d]					
11735800	Delivery methods for childbirth		.66			
11736000	Anesthesiology			.42		
11737000	First aid and care	.42	.45	.48		
11737100	Bandages, dressings, tourniquets, splints			.66		
11737200	Hemorrhage and bleeding and their arrest			.78		
11737300	Handling, transportation of the sick or wounded	.81				
11737400	Sprains, strains, fractures, and their healing	.89				
11737600	Resuscitation[d]					
11737700	Wounds and their healing	.83				
11738000	Asepsis	.76				
11744000	Dentistry[d]					
11744200	Oral surgery[d]					
11745000	Growth and development[d]					
11745100	Embryology, prenatal growth, development		.79			
11745200	Neonatal period growth, development[d]					

Table 2. (continued) p. 4 of 5

Knowledge Category Number and Abbreviated Name[b]		Factor Loadings[c]				
		Rad. Tech.	Ultrasd. Tech.	Radther. Tech.	Qual.Ass. Materials	Patient Care
12210000	Radiobiology	.68				
12220000	Radiology[d]					
12221000	Radiotherapy			.82		
12222000	Radionuclide therapy			.91		
12223000	Diagnostic radiography	.81			.43	
12224000	Radionuclide analysis		.54			
12300000	Pharmacology			.84		
12331000	Drug toxicity					.83
12332000	Drug idiosyncrasy, allergy pharmacogenetics					.82
12334000	Drug tolerance and physical dependence[d]					
12335000	Drug synergism					.94
12336000	Chemical teratogenesis[d]					
12341100	Antibacterial and antifungal chemotherapy					.70
12341300	Cancer and virus chemotherapy			.82		
12342100	Drugs acting on the cardiovascular system and smooth muscle					.94
12342200	Drugs acting on the blood					
12342300	Hormones and drugs acting on endocrine glands, accessory reproductive organs					
12342600	Drugs for allergy, cough, vomiting					.94
12342700	Drugs acting on gastrointestinal tract[d]					
12342810	Drugs acting on autonomic nervous system[d]					
12342820	Drugs acting on neuromuscular system[d]					
12342830	Drugs acting on the central nervous system	.70				
12342900	Drugs acting on the immunologic system[d]					
13322000	Properties of lead[d]					
13323000	Properties of the alkali metals[d]					
13332000	Properties of iron, cobalt, nickel[d]					
14111000	Solutions[d]					

Table 2. (continued) p. 5 of 5

	Factor Loadings[c]				
Knowledge Category Number and Abbreviated Name[b]	Rad. Tech.	Ultrasd. Tech.	Radther. Tech.	Qual.Ass. Materials	Patient Care
15212100 Electric circuit theory				.80	
15214100 Acoustics[d]					
15222100 Atomic structure[d]					
15222200 Atomic radiation processes[d]					
15222500 Interaction with radiation	.61		.43	.42	
24110000 Electromagnetic field theory applications[d]					
24112000 Transducers and rotating machines		.80			
24121000 Acoustic properties of materials		.90			
24124000 Ultrasonics		.91			
24132100 Electronic devices				.75	
25500000 Casting					
25600000 Tools and dies[d]					
25700000 Fabrication selection[d]					
33000000 Computer technology					
36220000 Processed metals					
36800000 Stone, marble and gems[d]					
37100000 Concrete, gypsum and plaster					
37700000 Plastics					
41666700 Death and dying behavioral development	.57		.51		
51200000 Algebra					
52220000 Descriptive statistics				.71	
65260000 Photography and cinematography[d]					
65620000 Mechanics of writing English	.64			.50	
Total Variables = 127					
Total Variables in Factor Analysis = 88					
Total Variables in Factor at ± .40 or Higher:	34	16	18	11	6
Number of Variables Unassigned at ± .40 or Higher = 21					
Total Variance Accounted for by Factor Solution = 53%					
Percentage Variance Accounted for by Factor:	20%	10%	12%	6%	7%

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APPENDIX B

TASK CONTENT OF JOBS, JOB SEQUENCES AND TASK FACTORS

Table 3. Tasks Assigned to Radiologic Technology Factor by Job Level, Point Score and Factor Loading. B-1

Table 4. Tasks Assigned to Radiation Therapy Technology Factor by Job Level, Point Score and Factor Loading. B-5

Table 5. Tasks Assigned to Diagnostic Ultrasound Technology Factor by Job Level, Point Score and Factor Loading. B-11

Table 6. Tasks Assigned to Quality Assurance, Materials Factor by Job Level, Point Score and Factor Loading. B-13

Table 7. Tasks Assigned to Patient Care Factor by Job Level, Point Score and Factor Loading. B-19

Table 8. Tasks Assigned to Administration (Non-factor A) by Job Level and Point Score. B-25

Table 3. TASKS ASSIGNED TO RADIOLOGIC TECHNOLOGY FACTOR BY JOB LEVEL, POINT SCORE AND FACTOR LOADING

p. 1 of 4

Task Code	Abbreviated Task Name and Job Level	Point Score	Factor Loading
	Level 3 (Technologist)		
526	Taking computerized transverse axial tomographic (C.T.T.) scans of any patient.	75	.41
374	Taking tomograms of non-infant patient.	74	.44
362	Taking plain film radiographs of sternum, ribs and/or thoracic viscera of non-infant patient.	72	.45
511	Taking catheter thoracic and/or abdominal aortograms of any patient, and/or selective visceral arteriograms (bronchial or abdominal).	72	.42
501	Taking percutaneous peritoneograms/herniograms of pediatric patient.	72	.41
512	Taking selective pelvic angiograms of non-pediatric gravid or nongravid female patient.	72	.39
494	Taking radiographs of neck, chest of infant patient.	71	.43
502	Taking excretory intravenous inferior vena cavograms and urograms of pediatric patient.	71	.40
516	Taking percutaneous splenoportograms of any patient.	71	.39
518	Taking selective pulmonary angiograms or selective angiocardiograms of any patient.	70	.41
509	Taking spinal cord angiograms of any patient.	70	.40
496	Taking plain film radiographs of the lower extremities of infant or pediatric patient.	70	.39
388	Taking infusion nephrotomograms of any patient.	70	.38
387	Taking intravenous pyelograms and urograms of non-pediatric patient.	70	.37

Note: Tasks are arranged in descending order by point score (difficulty as reflected in the number of skill and knowledge categories required and the scale values at which the categories are required). Factor loadings run from high, positive values, through zero, to negative values.

* Each task was assigned to the factor on which it has its highest loading. Task names marked with an asterisk (*) were assigned on the basis of logic. Tasks 81, 280, 372 and 373 load higher on the quality assurance factor at level 2; however, the knowledge categories required are more in keeping with those needed for the tasks in this factor. Task 280 is included on four factors, since it deals with radiation protection of the performer.

Table 3. RADIOLOGIC TECHNOLOGY (continued) p. 2 of 4

Task Code	Abbreviated Task Name and Job Level	Point Score	Factor Loading
	Level 3 (Technologist) continued		
519	Taking percutaneous coronary arteriograms and/or left ventriculograms of any patient.	69	.39
513	Taking intravenous angiocardiograms of any patient.	69	.39
515	Taking catheter inferior vena cavograms and/or renal or adrenal venograms of non-infant patient.	69	.39
514	Taking selective thyroid angiograms of any patient.	69	.39
376	Taking lymphangiograms or lymphadenograms of any patient.	69	.39
389	Taking percutaneous antegrade or renal cyst pyelograms of non-infant patient.	69	.38
500	Taking barium enema, intussusception or defecography radiographs of pediatric patient.	69	.38
363	Taking plain film radiographs of abdominal contents of non-infant patient.	69	.37
378	Taking bronchograms of a non-pediatric patient.	68	.40
499	Taking upper GI radiographs of pediatric patient.	68	.40
504	Taking cerebral angiograms or venograms of any patient.	68	.39
465	Taking pelvic pneumograms and/or hysterosalpingograms of non-pediatric female patient.	68	.37
390	Taking cystograms and voiding cystourethrograms of any patient.	68	.37
365	Taking plain film radiographs of the skull and/or face of non-infant patient.	67	.40
375	Taking sialograms of any patient.	67	.39
506	Taking positive contrast spinal or posterior fossa myelograms of any patient.	67	.39
508	Taking air or gas contrast myelograms of any patient.	67	.39
507	Taking diskograms of any patient.	67	.38
495	Taking plain film radiographs of abdomen of infant patient.	67	.36
503	Taking genitograms or fistulograms of any patient for intersex, external fistula or sinus tract examination.	67	.36
366	Taking plain film radiographs of the paranasal sinuses of a non-infant patient.	66	.38
505	Taking pneumoencephalograms or brain ventriculograms of any patient.	66	.38
377	Taking positive contrast arthrograms (especially of knee) of any patient.	66	.38
517	Taking selective subclavian arteriograms of non-pediatric patient for thoracic outlet syndrome evaluation.	66	.38

Table 3. RADIOLOGIC TECHNOLOGY (continued) p. 3 of 4

Task Code	Abbreviated Task Name and Job Level	Point Score	Factor Loading
	Level 3 (Technologist) continued		
510	Taking peripheral angiograms of any patient.	66	.36
463	Taking retrograde pyelograms and ureterograms of non-pediatric patient.	66	.34
360	Taking plain film radiographs of pelvis, hips and/or upper femora of non-infant patient.	65	.37
361	Taking plain film radiographs of vertebral column of non-infnat patient.	65	.37
492	Taking plain film radiographs of vertebral column of infant patient.	65	.37
493	Taking plain film radiographs of the upper extremities of infant patient.	65	.37
491	Taking plain film radiographs of the skull of infant patient.	65	.37
383	Taking barium enema radiographs of non-pediatric patient.	65	.35
355	Taking plain film radiographs of fingers, hand(s) or wrist(s) of non-infant patient.	64	.38
356	Taking plain film radiographs of forearm and/or elbow joint of non-infant patient.	64	.38
357	Taking plain film radiographs of humerus and/or shoulder girdle of non-infant patient.	64	.38
358	Taking plain film radiographs of toes, foot and/or ankle joint of non-pediatric patient.	64	.38
359	Taking plain film radiographs of leg(s), knee(s) and/or femur(s) of non-infant patient.	64	.38
364	Taking radiographs of anterior portion of the neck of non-infant patient.	64	.37
380	Providing technical assistance for laryngography or cleft palate study of any patient (or any similar fluoroscopic examination including spot filming and/or cineradiography).	64	.37
382	Taking small intestine intubation radiographs of a non-pediatric patient.	64	.35
379	Carrying out radiologic technology for bronchoscopy or needle lung biopsy of a non-pediatric patient.	64	.34
385	Taking intravenous cholangiograms and cholecystograms of non-infant patient.	64	.31
368	Taking mammograms (radiography or xeroradiography) of non-infant patient.	64	.31
498	Taking bronchograms of a pediatric patient.	63	.34
386	Taking percutaneous or T-tube cholangiograms of non-infant patient.	63	.32

Table 3. RADIOLOGIC TECHNOLOGY (continued) p. 4 of 4

Task Code	Abbreviated Task Name and Job Level	Point Score	Factor Loading
	Level 3 (Technologist) continued		
497	Taking radiographs for choanal atresia study of infant patient.	61	.30
367	Taking preliminary localization radiographs of foreign bodies in orbit or eye of non-infant patient.	61	.29
384	Taking oral cholecystograms and cholangiograms of non-infant patient.	61	.28
466	Taking radiographs of a pregnant patient's abdomen for fetography, amniography, placentography.	61	.27
381	Taking upper GI radiographs of non-pediatric patient.	60	.35
467	Taking radiographs of a pregnant patient's uterus for intrauterine transfusion.	60	.31
468	Taking radiographs of a pregnant patient's pelvis for Colcher-Sussman pelvimetry.	60	.28
370	Taking operative orthopedic radiographs of any patient (such as in hip pinning).	53	.17
371	Taking operative cholangiograms, pancreatograms or similar operative radiographs of any patient.	49	.06
464	Providing technical assistance for an examination of any patient requiring fluoroscopic control and spot filming.	43	.15
81	Providing technical quality review of "plain film" radiographs.*	41	-.00
373	Taking operating room radiographs for opaque foreign body search*	40	-.00
372	Taking intravisceral or isolated operating room radiographs of any patient.*	37	-.03
369	Preparing, transporting, setting up and returning mobile portable radiography equipment for bedside radiography.	32	-.07
280	Participating in monitoring of personal exposure to radiation by periodically turning in and replacing film strip in badge worn by performer.*	18	-.16

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* See first page of table.

Table 4. TASKS ASSIGNED TO RADIATION THERAPY TECHNOLOGY FACTOR BY JOB LEVEL, POINT SCORE AND FACTOR LOADING p. 1 of 5

Task Code	Abbreviated Task Name and Job Level	Point Score	Factor Loading
	Level 3 (Technologist)		
567	Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the whole abdomen, or female patient to receive external beam radiation of the reproductive system, using simulator or treatment machine.	91	.63
568	Carrying out simulation and initial set-up for any patient to recieve external beam radiation therapy of the whole pelvis, urinary bladder, or male patient to receive external beam radiation of the prostate, using simulator or treatment machine.	89	.64
603	Setting up and administering external beam radiation therapy to whole abdomen of radiotherapy patient or female patient to recieve external beam radiation of the reproductive system.	88	.66
599	Setting up any radiotherapy patient and administering external beam radiation therapy to the head and/or neck and/or spinal column.	88	.65
564	Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the thorax, such as lungs, pleura, esophagus, mediastinum, using simulator or treatment machine.	88	.58
563	Carrying out simulation and/or initial set-up for any patient to receive external beam radiation therapy of the head, neck, and/or spinal column, using simulator or treatment machine.	88	.56
571	Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the kidney and/or adrenal glands or neuroblastoma, using simulator or treatment machine.	85	.62

Note: Tasks are arranged in descending order within levels by point score (difficulty as reflected in the number of skill and knowledge categories required and the scale values at which the categories are required). Factor loadings run from high, positive values, through zero, to negative values.

* Each task was assigned to the factor on which it has its highest loading. Task names marked with an asterisk (*) were assigned on the basis of logic. Task 280 is included on two levels and four factors, since it deals with radiation protection of the performer. Tasks 576, 590, 591, 595, 596, 597, 613, 614 and 617 load higher on the quality assurance and materials factor; Task 575 loads higher on the radiologic technology factor.

Table 4. RADIATION THERAPY TECHNOLOGY (continued) p. 2 of 5

Task Code	Abbreviated Task Name and Job Level	Point Score	Factor Loading
	Level 3 (Technologist) continued		
570	Carrying out simulation and initial set-up for male patient to receive external beam radiation therapy of the penis, using simulator or treatment machine.	84	.61
566	Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the lymph nodes with mantle and/or "inverted-Y" field techniques or variations, using simulator or treatment machine.	84	.51
600	Setting up any radiotherapy patient and administering external beam radiation therapy to the thorax, for treatment of lungs, pleura, esophagus, or mediastinum.	84	.51
569	Carrying out simulation and initial set-up for male patient to receive external beam radiation therapy of the testis, using simulator or treatment machine.	83	.62
572	Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the bone and/or soft tissue of an extremity, using simulator or treatment machine.	83	.55
573	Carrying out simulation and/or initial set-up for any patient to receive external beam radiation therapy of the whole body.	83	.52
607	Setting up any radiotherapy patient and administering external beam radiation therapy to the kidney and/or adrenal glands.	82	.64
565	Carrying out simulation and initial set-up for any patient to receive external beam radiation therapy of the breast(s), using simulator or treatment machine.	81	.61
604	Setting up and administering external beam radiation therapy to the whole pelvis or urinary bladder of a radiotherapy patient or male patient to receive external beam radiation of the prostate.	80	.60
608	Setting up any radiotherapy patient and administering external beam radiation therapy to the bone and/or soft tissue of an extremity.	80	.58
605	Setting up a male radiotherapy patient and administering external beam radiation therapy to the testis.	79	.66
606	Setting up a male radiotherapy patient and administering external beam radiation therapy to the penis.	79	.62
609	Setting up any radiotherapy patient and administering external beam radiation therapy of the whole body.	79	.52

Task Code	Abbreviated Task Name and Job Level	Point Score	Factor Loading
	Level 3 (Technologist) continued		
602	Setting up any radiotherapy patient and administering external beam radiation therapy to the lymph nodes with mantle and/or "inverted-Y" field techniques or variations.	79	.50
601	Setting up any radiotherapy patient and administering external beam radiation therapy to the breast(s).	78	.62
581	Discussing, planning and arranging for mold room procedures to fabricate treatment devices such as shells, casts, masks, applicators, beam blocks, bolus, shields, etc. for use in radiation therapy.	74	.42
622	Taking localization radiographs and administering intracavitary radiation therapy with remote afterloader to any internal radiation therapy patient.	63	.17
562	Participating in discussion on, or answering questions about external beam radiation therapy equipment in relation to proposed treatment plan.	61	.35
575	Taking transverse axial tomograms of any patient.*	61	.10
561	Planning and arranging for pre-treatment procedures for external beam radiation therapy.	57	.43
583	Fabricating a treatment mold or applicator or solid cast for radiotherapy patient from dental impression compound, and/or plaster of Paris, or liquid resin acrylic, or stone plaster, using indirect technique.	54	.23
619	Taking localization films of intracavitary applicator or interstitial implant prior to treatment of a radiation therapy patient.	54	.19
615	Planning and arranging procedures for intracavitary or interstitial radiation therapy (brachytherapy).	51	.34
582	Fabricating a treatment shell or mask of plaster of Paris bandages using direct technique for radiotherapy patient.	47	.16
280	Participating in monitoring of personal exposure to radiation by periodically turning in and replacing film strip in badge worn by performer.*	18	-.08

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* See first page of table.

Task Code	Abbreviated Task Name and Job Level	Point Score	Factor Loading
	Level 2 (Technician)		
576	Assisting as ordered with localization, simulation and/or initial set-up procedures for any patient to receive external beam radiation therapy, using simulator or treatment machine as ordered.*	39	-.01
595	Fitting a radiotherapy treatment shell to a patient, fixing to supports and/or attaching straps.*	33	.01
587	Making an intraoral or surface stent or dental wax cast impression of a radiotherapy patient.	31	.04
594	Fabricating a contact or spatula-type internal eye shield for radiotherapy.	22	-.00
592	Fabricating and shaping radiotherapy lead shielding or mask cutouts on a plaster cast of radiotherapy patient.*	22	-.03
580	Taking photograph(s) of any patient's face and/or treatment areas as ordered.	20	-.03
574	Preparing a contour drawing at the appropriate treatment level(s) of any patient to recieve external beam radiation therapy.	19	.04
584	Preparing an intracavitary or surface applicator mold to receive radioactive sealed sources.	19	-.02
591	Fabricating lead shielding for radiotherapy treatment fields.*	19	-.05
586	Forming a plastic radiotherapy treatment shell from a solid or positive cast of plaster of Paris or stone plaster, using a vacuum forming machine.	18	-.03
598	Fabricating customized lead radiotherapy shielding beam blocks with styrofoam molds.	18	-.04
597	Fabricating radiotherapy styrofoam molds for beam blocking using marked radiograph, treatment geometry and a hot wire cutting device.*	18	-.07
280	Participating in monitoring of personal exposure to radiation by periodically turning in and replacing film strip in badge worn by performer.*	18	-.08
596	Preparing and/or arranging external beam radiotherapy beam blocks or compensating filters of prescribed shape and HVL for use in shadow tray.*	17	-.05

Table 4. RADIATION THERAPY TECHNOLOGY (continued) p. 5 of 5

Task Code	Abbreviated Task Name and Job Level	Point Score	Factor Loading
	Level 2 (Technician) continued		
590	Applying wax bolus to a radiotherapy treatment shell.*	16	-.05
613	Calculating and recording, or checking and reporting errors in calculations, in external beam radiation treatment plan or in therapy chart, such as effective area, dose time or monitor units, central axis depth dose, prescribed total tumor dose versus total given dose, according to predetermined formulae, using appropriate information.*	16	-.09
585	Preparing a solid cast of plaster of Paris or stone plaster for use as model in treatment planning or for shaping lead shields.	15	-.05
589	Preparing a lead bite-block or other lead block for radiotherapy use from a wax cast set in plaster mold.	15	-.05
617	Calculating treatment time for remote afterloader intracavitary radiation treatment or checking calculation.*	14	-.07
588	Fabricating a bite-block or other radiotherapy treatment mold from a wax cast.	13	-.07
614	Adding and recording accumulated given doses and/or weekly final tumor doses, or checking and reporting calculation errors, in radiotherapy treatment charts.*	13	-.07
612	Preparing external beam treatment equipment with appropriate attachments.*	12	-.08
593	Cutting treatment portals out of radiotherapy treatment shell.*	11	-.08

Table 5. TASKS ASSIGNED TO DIAGNOSTIC ULTRASOUND TECHNOLOGY FACTOR BY JOB LEVEL, POINT SCORE AND FACTOR LOADING p. 1 of 1

Task Code	Abbreviated Task Name and Job Level	Point Score	Factor Loading
	Level 3 (Technologist)		
625	Making B-scan ultrasonograms of any patient's abdominal contents, such as liver, gallbladder, pancreas, and/or spleen.	84	.59
631	Making A-mode and B-mode scan ultrasonograms of a fetal skull in utero.	82	1.11
623	Making B-scan ultrasonograms of a pregnant patient and fetus.	79	1.10
636	Making B-scan, A-mode and M-mode ultrasonograms of the fetal heart in utero for calculation of fetal heart rate.	77	1.04
630	Making A-mode echoencephalograms of any patient.	77	.54
629	Making B-scan ultrasonograms of any patient to differentiate free fluid from fixed fluid, such as in ascites.	77	.52
627	Making B-scan ultrasonograms of any patient's thoracic contents to study mediastinal masses, pulmonary emboli, pleural lesions, and/or pleural effusion.	77	.49
635	Making M-mode echocardiograms of the heart and pericardium of any patient.	75	.52
624	Making B-scan ultrasonograms of a female patient's pelvis to study reproductive organs, pelvic masses.	74	.67
628	Making B-scan ultrasonograms of superficial mass(es) of any patient.	71	.50
626	Making B-scan ultrasonograms of any patient's kidney(s).	70	.50
634	Making B-mode scan and A-mode ultrasonograms of any patient's abdominal aorta.	69	.51
637	Using Doppler ultrasonic motion detector to detect or monitor the fetal heart in utero.	64	.94
638	Using Doppler ultrasonic motion detector to evaluate blood flow, pressure, occlusion in neonate or any patient.	57	.57

Note: Each task was assigned to the factor on which it has its highest loading. Tasks are arranged in descending order by point score (difficulty as reflected in the number of skill and knowledge categories required and the scale values at which the categories are required).

Table 6. TASKS ASSIGNED TO QUALITY ASSURANCE, MATERIALS FACTOR BY JOB LEVEL, POINT SCORE AND FACTOR LOADING p. 1 of 6

Task Code	Abbreviated Task Name and Job Level	Point Score	Factor Loading
	Level 5 (Professional)[a]		
557	Collecting and presenting technical information about and/or recommending new diagnostic x-ray equipment.	56	.79
546	Designing, maintaining, evaluating radiation protection and monitoring programs in diagnostic radiology.	55	.72
528	Designing, maintaining, evaluating calibration and/or dose monitoring program in diagnostic radiology.	54	.76
547	Determining primary and secondary structural shielding required for diagnostic x-ray installations.	49	.56
542	Designing, maintaining, evaluating darkroom and/or film processor monitoring program in diagnostic radiology.	47	.62
541	Evaluating accepted and rejected radiographs to identify any technical problems with staff functioning, equipment, radiation protection.	41	.29
555	Investigating reasons for reported high occupational radiation exposure and initiating remediation.	39	.26

Note: Tasks are arranged in descending order within levels by point score (difficulty as reflected in the number of skill and knowledge categories required and the scale values at which the categories are required). Factor loadings run from high, positive values, through zero, to negative values (for lower-level tasks).

* Each task was assigned to the factor on which it has its highest loading. Task names marked with an asterisk (*) were assigned on the basis of logic. Low-level tasks load at such low levels on all factors that common sense assignments are appropriate.

[a] Point scores for this level are not comparable with those above level 2 on other factors, since the knowledge categories required for the physicist are broad subjects. If they were "broken down" into their component categories the point scores would be appropriately high in comparison with levels 3 and 4 on other factors.

Table 6. QUALITY ASSURANCE (continued) p. 2 of 6

Task Code	Abbreviated Task Name and Job Level	Point Score	Factor Loading
	Level 2 (Technician) continued		
545	Monitoring patient exposure rates for routine diagnostic x-ray procedures.	38	.19
535	Performing calibration tests of kVp, mA, mAs, exposure rates, reproducibility on diagnostic radiography equipment using direct measuring instruments and/or radiographic comparisons.	37	.48
550	Conducting protection survey of stray radiation within diagnostic x-ray installation and transmission across primary and secondary protective barriers.	36	.24
543	Monitoring and evaluating x-ray film processors.	35	.30
532	Checking and/or performing direct calibration tests of diagnostic radiography equipment exposure timers.	32	.28
544	Determining exposure characteristics of x-ray and/or dosimetric films.	32	.20
548	Checking maximum entrance exposure rate and primary barrier transmitted radiation rate for fluoroscopic equipment.	32	.19
531	Testing whether diagnostic x-ray tube overload protection and/or effective focal spot size meet acceptable standards.	31	.12
537	Checking diagnostic tomography x-ray equipment for mechanical operation, fulcrum position, resolution, exposure uniformity and/or grid alignment.	31	.10
529	Checking x-ray field limitation, x-ray receptor and light field alignment, minimum TOD, TFD and field size indicators for diagnostic x-ray equipment.	30	.12
530	Checking fluoroscopic and spot film x-ray field limitation, x-ray field and image receptor alignment, maximum TID, minimum TOD, and other requirements.	30	.12
539	Checking bucky grid alignment and/or centering in diagnostic radiography equipment.	30	.10
549	Checking the leakage radiation rate from the source assembly of diagnostic x-ray equipment.	29	.19
525	Checking calibration and accuracy of C.T.T. equipment by making test scans.	29	.13
540	Checking fluoroscopic automatic brightness control system and/or focus, resolution and distortion of the optical system.	29	.08

Table 6. QUALITY ASSURANCE (continued) p. 3 of 6

Task Code	Abbreviated Task Name and Job Level	Point Score	Factor Loading
	Level 2 (Technician) continued		
556	Calibrating diagnostic x-ray test, survey, or measuring instruments.	28	.28
533	Checking automatic exposure termination of diagnostic radiography equipment.	27	.07
538	Estimating HVL and checking adequacy of filtration of diagnostic x-ray equipment.	25	.18
175	Performing penetrometer calibration test of kVp or mA selectors of x-ray machine output.	24	.10
527	Retrieving, displaying and making photographs, printouts and/or magnetic tape records of computerized transverse axial tomographic (C.T.T.) scans	24	.03
553	Reading and recording exposure from personnel monitoring film or thermoluminescent dosimeters.	23	.11
639	Carrying out standard tests and calibration checks of diagnostic ultrasound equipment.*	22	.17
534	Providing visual and radiographic or fluoroscopic inspection of personnel shielding devices such as leaded gloves, aprons, sheets, gonadal shields.	22	.02
178	Checking, preparing fluoroscope controls (and phototimer).	21	.08
536	Providing visual and/or manual inspection of diagnostic radiography system.	20	.10
173	Checking accuracy of x-ray machine timers (except phototimers) with spinning top test.	20	.04
621	Transporting sealed radioactive isotopes within institution from storage to treatment area safes following appropriate safety precautions.	20	.01
524	Providing preventive maintenance for display tube surface, camera, disc and/or tape drive units, and/or scanning assembly (especially water-using head box assembly) of computerized transverse axial tomography (C.T.T.) equipment.	20	-.02
276	Making minor adjustments or repair on automatic x-ray film processor	19	.04

* See first page of table.

Table 6. QUALITY ASSURANCE (continued) p. 4 of 6

Task Code	Abbreviated Task Name and Job Level	Point Score	Factor Loading
	Level 2 (Technician) continued		
554	Entering, evaluating occupational radiation exposure data and initiating action on dangerous levels.	18	.03
280	Participating in monitoring of personal exposure to radiation by periodically turning in and replacing film strip in badge worn by performer.	18	-.02
78	Checking and jacketing patient's radiographs, ultrasonograms, and/or C.T.T. scans with requisition sheets and prior diagnostic materials and placing for filing or interpreting.*	17	-.04
523	Preparing computerized transverse axial tomography (C.T.T.) equipment for use.	16	.02
187	Checking cassettes for proper film-screen contact.	16	-.04
304	Readying emergency cart.*	16	-.08
147	Preparing or changing technique charts for specific x-ray and fluoroscopic equipment on orders.	15	.03
	Level 1 (Aide)		
192	Inspecting, checking, preparing xeroradiography equipment for use.*	14	-.07
80	Preparing materials or trays with medications and materials for special treatments or procedures according to standard orders.*	14	-.07
71	Processing exposed x-ray film manually.*	13	-.06
8	Shutting down computerized transverse axial scanning equipment.	12	-.01
273	Cleaning, inspecting and readying automatic x-ray film processor(s) for use.*	12	-.05
70	Inspecting, cleaning and readying x-ray film hand processing equipment for use.*	12	-.06
275	Preparing radiographic subtraction prints.*	12	-.07
552	Collecting and/or distributing personnel monitoring dosimetric badge inserts and preparing for outside or in-house processing and reading.*	12	-.10
69	Processing exposed x-ray film in automatic processor.*	12	-.11

Table 6. QUALITY ASSURANCE (continued) p. 5 of 6

Task Code	Abbreviated Task Name and Job Level	Point Score	Factor Loading
	Level 1 (Aide) continued		
354	Obtaining patient records for use in examination, procedure, treatment or conference.*	11	-.07
95	Testing a urine sample by tablet or dipstick method and recording.*	11	-.08
284	Checking presence and functioning of oxygen and/or suction equipment and amounts of oxygen.*	11	-.08
79	Preparing barium sulfate contrast medium as ordered or for standard use.*	11	-.11
260	Preparing a hypodermic needle with injection dosage on orders.*	11	-.13
134	Logging and/or tallying patient services and/or instructional case record materials for use in record keeping, billing or instruction.	10	-.04
76	Checking supplies and ordering non-drug materials needed by department.*	10	-.07
135	Cleaning an examination or treatment room after use.*	9	-.07
227	Checking for presence and condition of emergency supplies in proper locations; and restocking as needed.*	9	-.07
72	Loading x-ray film cassette(s), nonscreen film holder(s), box(es), and/or roll film cartridges.*	9	-.11
551	Preparing personnel radiation monitoring dosimetric film or TLD badges and distributing.*	9	-.13
129	Checking supply and ordering non-narcotic medicinals needed by department.*	8	-.10
136	Checking and storing order for non-narcotic drugs and/or supplies.*	8	-.10
151	Preparing treatment or examination room(s) for use.*	8	-.11
269	Loading empty cassette with Polaroid x-ray film.*	8	-.12
286	Filling out standard order for linen; picking up, folding and storing.*	7	-.11
632	Loading camera for photography of oscilloscope display; making exposures on orders; recording patient identification, date, series number, level and directional reference.*	7	-.12
128	Checking supply of narcotics or regulated drugs (or witnessing count); reordering, picking up, and restocking.*	7	-.13
145	Preparing treatment or examination equipment for sterilization in autoclave.*	7	-.13
180	Preparing blood samples for the laboratory.*	7	-.15

Table 6. QUALITY ASSURANCE (continued) p. 6 of 6

Task Code	Abbreviated Task Name and Job Level	Point Score	Factor Loading
	Level 1 (Aide) continued		
163	Filling out institutional report form (such as for cancellation) as ordered by MD.*	6	-.11
164	Filling out patient identification information on labels and forms in anticipation of need or as requested.*	6	-.11
274	Adding predetermined instruments and supplies to prepared procedure trays.*	6	-.11
297	Obtaining and checking keypunch control card for serial cassette changer as ordered.*	6	-.11
167	Inspecting and cleaning intensifying screens in cassette holders.*	6	-.12
267	Processing exposed Polaroid x-ray film with Polaroid automatic processing equipment.*	6	-.12
137	Delivering prepared specimens or cultures to lab or incubator.*	6	-.13
288	Filling out and delivering standard order for food items for department; picking up, and placing food for storage.*	6	-.13
300	Checking and submitting accumulated patient's treatment and medication check lists for in and out time stamps.*	6	-.13
319	Applying print coater to photographs.*	6	-.13
285	Checking for presence of emergency supplies in proper locations.*	5	-.13
184	Relocking equipment box(es) with breakaway lock.*	5	-.15
223	Making up unoccupied bed or stretcher bed.*	4	-.15
222	Making photocopies of documents, collating, and stapling.*	3	-.14
265	Filing or obtaining records from files by patient identification number and/or name.*	3	-.14
264	Ordering duplicate copies of forms, records, or documents.*	2	-.17

Table 7. TASKS ASSIGNED TO PATIENT CARE FACTOR BY JOB LEVEL, POINT SCORE AND FACTOR LOADING p. 1 of 5

Task Code	Abbreviated Task Name and Job Level	Point Score	Factor Loading
	Level 4 (Junior Professional in Emergency Care)[a]		
77	Providing emergency care for any patient having adverse reaction to radiographic contrast medium procedures, or accident.	83	.88
19	Administering test (intravenous) to any patient for allergy to iodine-based contrast medium.	70	.82
	Level 2 (Technician)[b]		
299	Administering subcutaneous or intramuscular injection for any patient according to MD's orders.[b]	59	1.03
133	Administering subcutaneous or intramuscular injection for any patient according to MD's orders after having quantity checked.[b]	56	1.03
296	Providing first aid in x-ray department emergency.[b]	56	.25
620	Assisting radiotherapist in application and/or removal of intracavitary applicator for remote or conventional afterloader radiation treatment of any patient.*	36	-.03

Note: Tasks are arranged in descending order within levels by point score (difficulty as reflected in the number of skill and knowledge categories required and the scale values at which the categories are required). Factor loadings run from high, positive values, through zero, to negative values (for low-level tasks).

* Each task was assigned to the factor on which it has its highest loading. Task names marked with an asterisk (*) were assigned on the basis of logic. Task 280 is included since it deals with radiation protection of the performer.

[a] Tasks at this level do not constitute a separate job, but suggest a possible clinical specialty that would include other tasks of a similar nature.

[b] Tasks 299, 133 and 296 could have been assigned to a level 3 grouping, the technologist level, which is not identified for this factor. That would correspond to the RN level. We do not feel that the three tasks warrant creation of a job at this level. An individual trained at level 2 in this factor would require the additional training for these three tasks, involving a knowledge of drugs, resuscitation, and injection procedures, and would also require special permission to function in states where injections require the RN license.

Table 7. PATIENT CARE (continued) p. 2 of 5

Task Code	Abbreviated Task Name and Job Level	Point Score	Factor Loading
	Level 2 (Technician) continued		
33	Removing any patient's sutures.	33	.25
298	Administering medication orally to any patient according to MD's orders.	32	.83
577	Applying lead contact or spatula-type internal eye shield under any radiotherapy patient's eyelid.	32	.03
579	Inserting balloon catheter or barium enema in any patient's rectum to localize tumor or rectum.*	32	.02
618	Reinforcing or informing internal radiation therapy patient about expected reactions to therapy, self care, and danger signs to report.*	32	-.02
578	Inserting radiopaque probe into female patient's vagina to localize tumor or cervix.	31	.08
156	Irrigating, cleaning, dressing or redressing any patient's wound, burn, or opening for catheter as ordered.	30	.00
181	Catheterizing any male or female patient's urethra with retention balloon catheter.	28	.03
198	Administering medication orally to any patient according to MD's orders after having quantity checked.	26	.83
143	Catheterizing any female urethra as ordered.	26	.03
65	Preparing specimens such as extravascular body fluids, washings, cell and/or tissue biopsies for transportation to laboratory.	25	.01
308	Setting up and monitoring any patient's electrocardiogram during special procedure.	24	-.00
616	Reassuring any radiotherapy patient and/or accompanying family member about intracavitary, or interstitial implant, or instillation, or remote afterloader procedures.*	24	-.02
610	Reassuring any radiotherapy patient and/or accompanying family member about external beam radiotherapy procedures.*	23	-.03

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* See first page of table.

Table 7. PATIENT CARE (continued) p. 3 of 5

Task Code	Abbreviated Task Name and Job Level	Point Score	Factor Loading
	Level 2 (Technician) continued		
185	Administering oxygen from portable or piped outlet unit using oronasal or nasal mask according to MD's orders.	21	.01
182	Setting up and using suction machine to clear airway or to assist with gastric lavage.	21	.00
18	Drawing blood from any non-pediatric patient's vein on orders.	20	.02
522	Applying pressure dressing to arterial or venous puncture site.	20	-.01
159	Checking reason for non-appearance of out-patient for examination or treatment and arranging for rescheduling.*	20	-.03
243	Restraining any patient.	19	-.01
194	Administering eye or ear drops to any patient on orders.	18	-.02
280	Participating in monitoring of personal exposure to radiation by periodically turning in and replacing film strip in badge worn by performer.*	18	-.03
	Level 1 (Aide)		
166	Using isolation and decontamination techniques to prepare examination or treatment room or area and clean up afterwards for patient with infectious or communicable condition.	17	-.01
262	Taking an electrocardiogram of any patient as ordered or determined.	17	-.01
290	Changing any patient's colostomy bag on orders.	17	-.01
520	Preparing any patient and attaching electrodes for electrocardiogram monitoring.	17	-.01
633	Reassuring any patient and/or accompanying adult about diagnostic ultrasound procedures and/or explaining prior fluid intake if appropriate.*	17	-.01
73	Reassuring any patient and/or accompanying adult about x-ray and/or fluoroscopy procedures.	17	-.02
193	Having any patient and materials prepared for special procedure and readying patient for examination.	17	-.02
283	On orders, deciding whether wound of any patient needing change of dressing needs attention of RN; changing simple dry dressing or reinforcing wet dressing.	17	-.02
190	Assisting patient to or from wheelchair, stretcher, bed, or table and/or transporting patient to designated area.	17	-.03

Table 7. PATIENT CARE (continued) p. 4 of 5

Task Coce	Abbreviated Task Name and Job Level	Point Score	Factor Loading
	Level 1 (Aide) continued		
521	Applying digital or manual pressure to any patient's arterial or venous puncture site as ordered.	16	-.01
138	Reporting observed symptoms and concerns of any patient to physician or staff member.	16	-.02
490	Mummying or wrapping an infant or young pediatric patient.	16	-.02
116	Deciding on and/or arranging for transportation for out-patient to and/or from treatment or examination.	16	-.03
611	Explaining to any out-patient or accompanying family member proper at-home procedures to follow prior to coming for radiation therapy treatment.	16	-.03
153	Assisting physician or co-worker in special examination or treatment procedures.	15	-.01
199	Taking and recording vital signs (temperature, pulse, respiration and blood pressure) of any patient.	15	-.02
287	On orders, placing order for specific dietetic meal; picking up, delivering, and feeding patient if so decided.	14	-.02
195	Applying an eye patch for any patient on orders.	14	-.04
113	Giving any patient general reassurance.	13	-.02
282	Escorting adult out-patients to and/or from dressing rooms, treatment rooms and/or waiting areas.	13	-.02
303	Arranging, measuring and recording food intake and excretory output as ordered.	13	-.02
74	Explaining to any out-patient or accompanying adult proper at-home procedures to follow prior to coming for radiographic or fluoroscopic examination.	13	-.03
278	Checking on reasons for nonappearance of in-patients for examinations or treatment.	12	-.03
289	Bottle feeding a baby with pre-prepared formula.	11	-.02
271	Deciding whether to call staff person to evaluate whether unusual ECG reading is artifact, or calling physician in case of serious patient distress.	11	-.03
302	Placing or making call and delivering non-medical message at patient or co-worker's request.	11	-.03

Table 7. PATIENT CARE (continued) p. 5 of 5

Task Code	Abbreviated Task Name and Job Level	Point Score	Factor Loading
	Level 1 (Aide) continued		
301	Diapering a baby.	10	-.02
155	Obtaining urine specimen on orders.	10	-.03
292	Obtaining and examining fresh stool from any patient and reporting unusual or suspicious appearance, on orders.	10	-.03
98	Obtaining a clean catch urine specimen from any patient and preparing for laboratory.	9	-.02
281	Checking in-patients' identity against patients' treatment and medication check lists; stamping arrival and departure times; attaching cards to patients indicating special conditions.	8	-.03
291	Taking and reporting temperature of any non-pediatric patient with oral thermometer on orders.	7	-.04
279	Notifying ward or floor personnel to ready and transport in-patients who are scheduled for specific procedures at specific times.	6	-.04

Table 8. TASKS ASSIGNED TO ADMINISTRATION (NON-FACTOR A) BY JOB LEVEL AND POINT SCORE[a]

p. 1 of 1

Task Code	Abbreviated Task Name and Job Level	Point Score
	Level 3 (Technologist)	
124	Arranging to cover temporary or permanent staff shortages.	13
272	Preparing and adjusting schedules for patient procedures.	10
186	Orienting new staff member(s) to departmental standard operating and administrative procedures, floor plan, location of equipment and supplies, record keeping.	10
131	Making assignments of staff to work areas, procedures, and/or MD's and/or vacations and lunch hours.	9
165	Keeping attendance records and recording or reporting excessive lateness and/or absenteeism.	9
277	Assigning scheduled patients to procedure rooms in appropriate order.	8
294	Assigning subordinate and explaining assignment to transport patient, obtain materials or documents, or assist co-worker.	7
132	Requesting repair, replacement or other services of another hospital department orally and/or filling out requisition.	6

Note: Tasks are arranged in descending order by point score (difficulty as reflected in the number of skill categories and the scale values at which they are required). These tasks are assigned to the technologist level based on logic.

[a] This group of tasks is referred to as non-factor A, since this does not constitute a separate task factor in the factor solution, and the tasks would rarely constitute a complete and separate job.

APPENDIX C

HEALTH SERVICES MOBILITY STUDY SCALES

Scale 1 Task Frequency C-1
Scale 2 Locomotion Skills C-2
Scale 3 Object Manipulation Skills C-3
Scale 4 Guiding or Steering Skills C-4
Scale 5 Human Interaction Skills C-5
Scale 6 Leadership Skills C-6
Scale 7 Oral Use of a Relevant Language C-8
Scale 8 Reading Use of a Relevant Language C-9
Scale 9 Written Use of a Relevant Language C-10
Scale 10 Decision Making on Methods C-11
Scale 11 Decision Making on Quality C-12
Scale 12 Figural Skills C-13
Scale 13 Symbolic Skills C-14
Scale 14 Taxonomic Skills C-15
Scale 15 Implicative Skills C-16
Scale 16 Financial Consequences of Error C-18
Scale 17 Consequences of Error To Humans C-19
Scale 18 Levels of Knowledge C-20

Scale 1. TASK FREQUENCY

This scale refers to the frequency with which the task being scaled is executed by the performer. Tasks which are regularly done should be scaled by using the wording outside of the parentheses in the statements presented below. Tasks which are done infrequently or in concentrated periods during the year should be scaled by using the wording within the parentheses; the figures represent conversions to a normal work year.

SCALE VALUE	DESCRIPTIVE STATEMENT
0	Task is never done.
1	Task is done once per year or less.
2	Task is done more often than once per year, but less than once per month (no more than 11 times per year).
3	Task is done once per month or more, but less often than once per week (no more than 33 times per year).
4	Task is done once per week or more, but less often than once per day (no more than 180 times per year).
6	Task is done once per day or more, but less often than five times per day (no more than 912 times per year).
7	Task is done five times per day or more, but less often than ten times per day (no more than 2,052 times per year).
8	Task is done ten times per day or more, but less often than fifty times per day (no more than 11,172 times per year).
9	Task is done fifty times per day or more (11,173 times per year or more).

Note: This scale is not used for clustering tasks. Ratings on this scale are relevant only at the level of the institution.

Scale [illegible]. LOCOMOTION

This skill refers to the degree of body coordination required of a performer in the task being scaled. The skill involves the movement of the performer's body, torso or limbs through space in order to achieve predetermined standards of body movement or position.

The level of the skill rises with the degree of body coordination required. This is determined by the complexity of the standards involved, or the complexity of external conditions which restrict motion. The scale level is not determined by requirements for strength nor by the level of knowledge which may be required.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to move his body, torso or limbs through space so as to achieve a predetermined standard for body motion or position.
1.5	The task requires the performer to move his body, torso, or limbs through space so as to achieve simple, predetermined standard(s) for body motion or position. A small degree of body coordination is called for.
5.0	The task requires the performer to move his body, torso, or limbs through space so as to achieve somewhat complex, predetermined standards for body motion or position. A moderate degree of body coordination is called for.
7.0	The task requires the performer to move his body, torso or limbs through space so as to achieve considerably complex, predetermined standards for body motion or position. A high degree of body coordination is called for.
9.0	The task requires the performer to move his body, torso or limbs through space so as to achieve extremely complex, predetermined standards for body motion or position. An extremely high degree of body coordination is called for.

Scale 3. OBJECT MANIPULATION

This skill refers to the degree of control required of a performer in directly manipulating objects in the task being scaled. The skill involves the direct handling of objects using fingers, hands or limbs to achieve a predetermined standard.

The level of the skill rises with the degree of precision required and with the fineness of the manipulation involved. When fingers, hands or limbs manipulate an object in order to manipulate another object, the skill level reflects the direct manipulation involving the fingers, hands or limbs. The scale level is not determined by the level of knowledge needed to manipulate objects nor by the level of other manual skills or Figural Skills required.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to directly handle objects with the fingers, hands or limbs so as to achieve a predetermined standard within constraints that require control and precision.
1.5	The task requires the performer to exercise a small amount of control and precision in directly manipulating objects with the fingers, hands or limbs in order to achieve a predetermined standard. Fairly gross motions are involved.
3.5	The task requires the performer to exercise a moderate amount of control and precision in directly manipulating objects with the fingers, hands or limbs in order to achieve a predetermined standard. Fairly gross motions are involved.
5.0	The task requires the performer to exercise a moderate amount of control and precision in directly manipulating objects with the fingers, hands or limbs in order to achieve a predetermined standard. Fairly fine motions are involved.
7.5	The task requires the performer to exercise a high degree of control and precision in directly manipulating objects with the fingers, hands or limbs in order to achieve a predetermined standard. Fairly fine motions are involved.
9.0	The task requires the performer to exercise a high degree of control and precision in directly manipulating objects with the fingers, hands or limbs in order to achieve a predetermined standard. Extremely fine motions are involved.

Scale 4. GUIDING OR STEERING

This skill refers to the degree of precision required of a performer in the task being scaled in moving an object over a predetermined pathway or holding steady on a moving target. The skill involves coordinating the performer's perceptions of external stimuli which tell him his position with his control of the object, in relation to the desired position or movement. The predetermined pathway or moving target may be actual or visualized.

The level of the skill rises as the precision needed rises (or the relative margin for error declines), and as the complexity of stimuli or the number of spatial directions or movements involved increase. The scale level is not determined by the degree of arm-hand steadiness involved, nor by the Figural Skills involved, nor by the level of knowledge required to accomplish the guiding or steering.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to move an object over a predetermined pathway or hold steady on a moving target.
1.5	The task requires the performer to move an object over a predetermined pathway or hold steady on a moving target. The movement requires a small degree of precision within a fairly large, acceptable relative margin of error. The performer must pay attention to a small number of external stimuli and/or spatial directions.
3.0	The task requires the performer to move an object over a predetermined pathway or hold steady on a moving target. The movement requires a small degree of precision within a fairly large, acceptable relative margin of error. The performer must pay attention to a fairly complex set of external stimuli and/or spatial directions.
5.5	The task requires the performer to move an object over a predetermined pathway or hold steady on a moving target. The movement requires a considerable degree of precision within a narrow, acceptable relative margin of error. The performer must pay attention to a fairly complex set of external stimuli and/or spatial directions.
7.0	The task requires the performer to move an object over a predetermined pathway or hold steady on a moving target. The movement requires a considerable degree of precision within a narrow, acceptable relative margin of error. The performer must pay attention to an extremely complex set of external stimuli and/or spatial directions.
9.0	The task requires the performer to move an object over a predetermined pathway or hold steady on a moving target. The movement requires a very high degree of precision within an extremely narrow, acceptable relative margin of error. The performer must pay attention to an extremely complex set of external stimuli and/or spatial directions.

Scale 5. HUMAN INTERACTION

This skill refers to the degree of sensitivity to others required of the performer in the task being scaled. The skill involves the performer's perception of the relevant characteristics or state of being of the other person(s), the performer's attention to feedback as the interaction occurs, and the performer's appropriate modification of his behavior so as to accomplish the task. The skill is involved if the task requires any personal contact or interaction with others.

The level of the skill rises as the degree of perceptiveness and sensitivity required of the performer rises, and as the subtlety of the feedback to which he or she must respond increases. The scale level is not determined by the level of knowledge required.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to be in contact with or to interact with other people.
1.0	The task requires the performer to be in only general contact with other people. Very little sensitivity to or perception of the other person(s)' relevant general characteristics or state of being is required, and little awareness of very obvious feedback is required for the performer to adjust his behavior to perform the task.
3.0	The task requires the performer to interact with others in the performance of the task. The performer is required to be somewhat sensitive to or perceptive of the other person(s)' relevant general characteristics or state of being, and to be aware of very obvious feedback so as to adjust his behavior accordingly.
5.0	The task requires the performer to interact with others in the performance of the task. The performer is required to be quite sensitive to or perceptive of the other person(s)' relevant characteristics or state of being, and to be aware of fairly obvious feedback so as to adjust his behavior accordingly.
7.0	The task requires the performer to interact with others in the performance of the task. The performer is required to be keenly sensitive to or perceptive of the other person(s)' relevant characteristics or state of being, and to be aware of fairly subtle or complex feedback so as to adjust his behavior accordingly.
9.0	The task requires the performer to interact with others in the performance of the task. The performer is required to be keenly sensitive to or perceptive of the other person(s)' relevant characteristics or state of being, and to be aware of very subtle or very complex feedback so as to adjust his behavior accordingly.

Scale 6. LEADERSHIP
p. 1 of 2

This skill refers to the degree to which leadership in interacting with subordinates is required on the part of the performer in the task being scaled. The skill is involved when the performer's task requires him to interact with subordinates so as to affect their work performance in order for the performer to achieve goals related to the task. The subordinate relationship may be *de facto* as well as formal.

The level of this skill rises in relation to three aspects of the performer's relationship with subordinates which are relevant to the task situation. These are: (1) power over subordinates' conditions of employment; (2) clearness of mutual channels of communication; and (3) clearness of subordinates' own relevant task procedures.

Low levels of Leadership are required when the performer has a great deal of power over the subordinates' conditions of employment, when the performer has very formal and clearly defined channels of communication with the subordinates relevant to the task situation, and when the tasks of the subordinates related to the performer's objectives are very clear cut, obvious, and require little discretionary judgment.

High levels of Leadership are required when the performer's power is low, when channels of communication are vague and undefined, and when the relevant subordinates' tasks are vague and require a great deal of discretionary judgment.

The level of Leadership required for the task being scaled is determined by the combination of ratings of high, medium or low for each of the three aspects. The parentheses for each statement indicate the various combinations for each scale value.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to relate to subordinates.
1.0	The task requires the performer to relate to subordinates in order to achieve work goals. The performer is understood to have a *great amount of power* over the related subordinates' conditions of employment. *Channels of communication* between the performer and the subordinates are *very formalized and very well defined*. The subordinates' *related tasks are very clear cut, obvious and require little discretionary judgment*. (*Low range of Leadership needs on each of the three aspects*. Also included: *two lows and one medium*.)

(continued on next page)

Scale 6. LEADERSHIP (continued)

p. 2 of 2

SCALE VALUE	DESCRIPTIVE STATEMENT
3.0	The task requires the performer to relate to subordinates in order to achieve work goals. The performer is understood to have a moderate amount of power over the related subordinates' conditions of employment. The channels of communication between the performer and the subordinates are somewhat formalized and moderately well defined. The subordinates' related tasks are very clear cut, obvious, and require little discretionary judgment. (Mid-range of Leadership needs on two out of the three aspects and low on a third. Also included: two lows and one high.)
4.5	The task requires the performer to relate to subordinates in order to achieve work goals. The performer is understood to have a moderate amount of power over the related subordinates' conditions of employment. The channels of communication between the performer and the subordinates are somewhat formalized and moderately well defined. The subordinates' related tasks are moderately clear cut, requiring some discretionary judgment. (Mid-range of Leadership needs on each of the three aspects. Also included: one low, one medium and one high; and two mediums and a high.)
6.5	The task requires the performer to relate to subordinates in order to achieve work goals. The performer is understood to have a moderate amount of power over the related subordinates' conditions of employment. The channels of communication between the performer and the subordinates are very informal, vague or irregular. The subordinates' related tasks are vaguely defined and require a great deal of discretionary judgment. (High rating for Leadership on two out of three aspects.)
8.5	The task requires the performer to relate to subordinates in order to achieve work goals. The performer is understood to have very little power over the related subordinates' conditions of employment. The channels of communication between the performer and the subordinates are very informal, vague or irregular. The subordinates' related tasks are vaguely defined and require a great deal of discretionary judgment. (High ratings for Leadership on all three aspects.)

Scale 7. ORAL USE OF A RELEVANT LANGUAGE

This skill refers to the level of precision in comprehension of heard language required of the performer in the task being scaled, and to the level of precision required in conveying meaning orally in the task situation. (The language referred to is the one in common use for the task.)

The level of this skill rises as the degree of precision in oral use of the language required in the task rises. The level of the scale is not determined by the knowledge reflected in the language used, nor by the skill of vocal delivery involved.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to understand spoken language or to speak.
2.0	The task requires the performer to understand and to convey meaning through the oral use of language. A low level of precision in choice of or comprehension of language is sufficient to accomplish the task.
4.0	The task requires the performer to understand and to convey meaning through the oral use of language. A moderate amount of precision in choice of or comprehension of language is necessary to accomplish the task.
7.5	The task requires the performer to understand and to convey meaning through the oral use of language. A fairly high degree of precision in choice of or comprehension of language is necessary to accomplish the task.
9.0	The task requires the performer to understand and to convey meaning through the oral use of language. A very high degree of precision and awareness of nuance in choice of or comprehension of language is necessary to accomplish the task.

Scale 8. READING USE OF A RELEVANT LANGUAGE

This skill refers to the level of comprehension required of the performer in his reading of written or printed material in the task being scaled. (The language referred to is the one in common use for the task.)

The level of this skill rises as the degree of precision in the reading use of the language required in the task rises. The level of this scale is not determined by the knowledge reflected in the material which is read.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to read and understand written language.
2.0	The task requires the performer to read and comprehend the general meaning of simple written language.
5.0	The task requires the performer to read and comprehend the general meaning of moderately complex written language.
7.0	The task requires the performer to read and comprehend the general meaning of complex written language.
9.0	The task requires the performer to read and comprehend the precise meaning and nuance of complex written language.

Scale 9. WRITTEN USE OF A RELEVANT LANGUAGE

This skill refers to the level of precision required of the performer in conveying meaning in the task being scaled through the written use of language. (The language referred to is the one in common use for the task.)

The level of this skill rises as the degree of precision in the written use of the language required in the task rises. The level of this scale is not determined by the knowledge reflected in the language used, nor by the level of knowledge of grammar or of literary form required.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to write language.
2.0	The task requires the performer to convey general meaning by writing in simple language.
5.0	The task requires the performer to somewhat precisely convey meaning by writing in moderately complex language.
6.5	The task requires the performer to fairly precisely convey meaning by writing in complex language.
9.0	The task requires the performer to very precisely convey meaning by writing in very complex language.

Scale 10. DECISION MAKING ON METHODS

This skill refers to the degree of responsibility required of a performer with respect to decisions he must make about how he does the task being scaled. How the task is done (the method) includes what is done, when, in what order, what is used, and who is involved. When the performer has any amount of latitude in deciding how to do the task, the skill is involved.

The skill rises as the choice of methods in the task situation are less and less obvious or specified; the skill rises as the circumstances of the task from one instance to another are more and more varied. The level of this scale is not determined by the level of knowledge required.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The performer is not required to decide on how to do any part of the task.
1.5	The performer is required to decide how to do all or part of the task. Instances of the task vary little with respect to the methods to choose from, and once the situation is known, the performer's choice is obvious and/or specified.
3.0	The performer is required to decide how to do all or part of the task. Instances of the task vary little with respect to the methods to choose from, and the performer's choice is arrived at by referring to general guidelines for choosing an appropriate method.
4.5	The performer is required to decide how to do all or part of the task. Instances of the task vary somewhat with respect to the methods to choose from, and the performer's choice is arrived at by referring to general guidelines for choosing an appropriate method.
7.0	The performer is required to decide how to do all or part of the task. Instances of the task cover a wide range of circumstances calling for very different methods, and the performer's choice is arrived at by referring to general guidelines for choosing an appropriate method.
9.0	The performer is required to decide how to do all or part of the task. Instances of the task cover a wide range of circumstances calling for very different methods, and once the situation is assessed, the performer must make his choice by applying his own guidelines for selecting an appropriate method.

Scale 11. DECISION MAKING ON QUALITY

This skill refers to the degree of responsibility required of the performer with respect to decisions he must make about the quality of the output he produces in the task being scaled. The scale refers to the performer's latitude beyond the minimum acceptable levels of task performance. The skill is involved when the performer has any effect on the quality of the task's output beyond minimum requirements.

The skill rises with the extent to which the performer can affect the output's quality. It is also affected by whether or not the output is subject to review or inspection by others before it is used. The level of this scale is not determined by the level of knowledge required nor by the possibility of making errors.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The performer is unable to affect the quality of the task's output.
1.5	The performer's exercise of choice in his standards of task performance can have only a minor effect on the quality of the task's output beyond minimum requirements, and the output is subject to complete and automatic review or inspection by someone else before it is used.
2.0	The performer's exercise of choice in his standards of task performance can have only a minor effect on the quality of the task's output beyond minimum requirements, and the output is subject to review or inspection by someone else before it is used.
3.5	The performer's exercise of choice in his standards of task performance can have only a minor effect on the quality of the task's output beyond minimum requirements, and the output is not subject to review or inspection by anyone else before it is used.
5.5	The performer's exercise of choice in his standards of task performance can have considerable effect on the quality of the task's output beyond minimum requirements, but the output is subject to review or inspection by someone else before it is used.
7.0	The performer's exercise of choice in his standards of task performance can have conciderable effect on the quality of the task's output beyond minimum requirements, and the output is not subject to review or inspection by anyone else before it is used.
9.0	The performer's exercise of choice in his standards of task performance can completely determine the quality of the task's output due to the absence of minimum requirements, and the output is not subject to review or inspection by anyone else before it is used.

Scale 12. FIGURAL SKILLS

This skill refers to the level of complexity required of the performer in the task being scaled in dealing with figural aspects of materials. The skill involves the mental manipulation of figural properties in order to achieve a predetermined figural standard or objective. The figural aspects involved are limited to size, shape, form, or arrangement of materials in relation to space, whether the mental images involved or the materials dealt with are static or in motion. A figural standard would involve norms or criteria for size, shape, form or their arrangements in space.

The skill rises as the complexity of the figural standards which must be achieved to perform the task rise, and as the complexity of the figural relationships whose aspects the performer must deal with rise. The level of this scale is not determined by the level of knowledge nor by the level of manual skills required.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to achieve a figural objective or standard involving size, shape, form, or arrangement of materials in relation to space, whether static or in motion.
1.0	The task requires the performer to achieve *simple figural objectives*, or meet *simple figural standards* involving the size, shape, form, or arrangement of materials in relation to space, whether static or in motion. The materials which are perceived or conceived of are dealt with in terms of their *simple figural relationships*.
3.5	The task requires the performer to achieve *moderately complex figural objectives*, or meet *moderately complex figural standards* involving the size, shape, form, or arrangement of materials in relation to space, whether static or in motion. The materials which are perceived or conceived of are dealt with in terms of their *simple figural relationships*.
5.0	The task requires the performer to achieve *moderately complex figural objectives*, or meet *moderately complex figural standards* involving the size, shape, form, or arrangement of materials in relation to space, whether static or in motion. The materials which are perceived or conceived of are dealt with in terms of their *moderately complex figural relationships*.
7.0	The task requires the performer to achieve *moderately complex figural objectives*, or meet *moderately complex figural standards* involving the size, shape, form, or arrangement of materials in relation to space, whether static or in motion. The materials which are perceived or conceived of are dealt with in terms of their *highly complex figural relationships*.
9.0	The task requires the performer to achieve *highly complex figural objectives*, or meet *highly complex figural standards* involving the size, shape, form, or arrangement of materials in relation to space, whether static or in motion. The materials which are perceived or conceived of are dealt with in terms of their *highly complex figural relationships*.

Scale 13. SYMBOLIC SKILLS

This skill is called for when the performer is required by the task being scaled to manipulate or use abstract symbols which are part of a system of symbolic notation. The skill involves the use of or manipulation of symbolic properties in such systems as numerical, musical, or code notations. The skill does not involve the semantic meaning or the figural properties of the symbols, nor use of single, one-to-one symbols which are not part of a system of notation, nor use of representational symbols.

The skill rises with the degree of complexity of the manipulation or use made of the symbols and with the complexity of the symbolic properties of the symbols. The level of this scale is not determined by the level of knowledge or subject matter represented by the symbols, nor by the figural properties of the symbols involved.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to manipulate or use abstract symbols which are part of a system of notation.
1.5	The task requires the performer to manipulate or use in simple operation(s), simple abstract symbols which are part of a system of notation.
3.5	The task requires the performer to manipulate or use in simple operation(s), fairly complex, abstract symbols which are part of a system of notation.
5.0	The task requires the performer to manipulate or use in fairly complicated operations(s), fairly complex, abstract symbols which are part of a system of notation.
7.0	The task requires the performer to manipulate or use in fairly complicated operation(s), highly complex, abstract symbols which are part of a system of notation.
9.0	The task requires the performer to manipulate or use in highly complicated operation(s), highly complex, abstract symbols which are part of a system of notation.

Scale 14. TAXONOMIC SKILLS

This skill is called for when the performer is required by the task being scaled to consciously apply or create conceptual classifying or organizing principles. The skill involves the application of mental processes to assign an unknown set of information to existing conceptual classes or systems, or the creation of conceptual classes or systems to suit the needs of the task. The skill does not involve the use of intuitive judgment, the use of simply figural or symbolic principles, or the one-to-one matching of obvious characteristics.

When conceptual organizing or classifying principles are to be applied, the skill rises with the level of complexity of the principles. When conceptual organizing or classifying principles are to be created, the skill rises with the level of complexity of the purposes they must serve in the task. The level of this scale is not determined by the level of knowledge nor by the level of the other intellectual skills required.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to consciously apply or create conceptual principles of classification or organization.
2.0	The task requires the performer to consciously apply simple conceptual principles of classification or organization; or to create conceptual principles with which to organize or classify information to suit simple needs in the task situation.
5.5	The task requires the performer to consciously apply somewhat complex conceptual principles of classification or organization; or to create conceptual principles with which to organize or classify information to suit somewhat complex needs in the task situation.
7.0	The task requires the performer to consciously apply considerably complex conceptual principles of classification or organization; or to create conceptual principles with which to organize or classify information to suit considerably complex needs in the task situation.
9.0	The task requires the performer to consciously apply extremely complex conceptual principles of classification or organization; or to create conceptual principles with which to organize or classify information to suit extremely complex needs in the task situation.

Scale 15. IMPLICATIVE SKILLS

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This skill is called for when a performer must come to conclusions or draw implications in the task being scaled which go beyond the memorization of cause and effect relationships or simple associations. The skill involves the application of mental processes to deal with a set of information so as to draw non-routine conclusions or inferences or to foresee consequences in the performance of the task.

The skill rises with the degree of complexity of the information with which the performer must deal in drawing implications, and rises with the extent to which the kinds of information from which the conclusions or inferences are to be drawn vary from one instance of the task to another. The level of this scale is not determined by the seriousness of the errors in judgment which could be involved, nor by the level of knowledge, nor by the level of other intellectual skills required.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to go beyond memorization of cause and effect relationships or simple associations to draw conclusions or inferences from a set of information.
1.0	The task requires the performer to go beyond memorization of cause and effect relationships or simple associations to draw conclusions or inferences from a set of relatively straight-forward or uncomplex information. The kinds of information from which the conclusions or inferences must be drawn vary little from one instance of the task to another.
2.0	The task requires the performer to go beyond memorization of cause and effect relationships or simple associations to draw conclusions or inferences from a set of relatively straight-forward or uncomplex information. The kinds of information from which the conclusions or inferences must be drawn vary somewhat from one instance of the task to another.
4.0	The task requires the performer to go beyond memorization of cause and effect relationships or simple associations to draw conclusions or inferences from a set of moderately complex information. The kinds of information from which the conclusions or inferences must be drawn vary little from one instance of the task to another.
5.0	The task requires the performer to go beyond memorization of cause and effect relationships or simple associations to draw conclusions or inferences from a set of moderately complex information. The kinds of information from which the conclusions or inferences must be drawn vary somewhat from one instance of the task to another.

(continued on next page)

Scale 15. IMPLICATIVE SKILLS (continued)

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SCALE VALUE	DESCRIPTIVE STATEMENT
8.0	The task requires the performer to go beyond memorization of cause and effect relationships or simple associations to draw conclusions or inferences from a set of extremely complex or extremely ambiguous information. The kinds of information from which the conclusions or inferences must be drawn vary somewhat from one instance of the task to another.
9.0	The task requires the performer to go beyond memorization of cause and effect relationships or simple associations to draw conclusions or inferences from a set of extremely complex or extremely ambiguous information. The kinds of information from which the conclusions or inferences must be drawn vary a great deal from one instance of the task to another.

Scale 16. FINANCIAL CONSEQUENCES OF ERROR

This skill refers to the degree of responsibility carried by a performer with respect to the financial damage which could result from errors in his performance of the task being scaled. The error whose consequences would be rated would be the most serious likely error to be expected from a performer qualified to do the task. The skill is involved if errors in performance of the task have any financial consequences involving any output, equipment, materials, time or other chargeable items. The level of this scale is not determined by the value of insurance claims or damage suits which would result from harm to humans.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	No likely error in the performer's task performance could result in financial damage to the institution.
1.0	The most serious likely error in the performer's task performance would result in negligible financial damage to the institution.
4.0	The most serious likely error in the performer's task performance would result in financial damage to the institution of a relatively moderate but manageable amount.
6.0	The most serious likely error in the performer's task performance would result in financial damage to the institution of an amount considered to be relatively difficult to absorb.
7.5	The most serious likely error in the performer's task performance would result in financial damage to the institution of an amount considered to be extremely serious and extremely difficult to absorb.
9.0	The most serious likely error in the performer's task performance would result in financial damge to the institution of an amount so serious that the institution would cease to exist.

Scale 17. CONSEQUENCES OF ERROR TO HUMANS

This skill refers to the degree of responsibility carried by the performer with respect to the harm which could be done to humans as a result of errors in his performance of the task being scaled. The error whose consequences are rated would be the most serious likely error to be expected from a performer qualified to do the task. The skill is involved if errors in performance of the task result in any physical or mental harm to humans, including recipients, respondents, co-workers, or persons not directly related to the task. The performer is included. The level of this scale is not determined by any financial harm which could be done to persons.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	No likely error in the performer's task performance could result in harm to a human.
1.0	The most serious likely error in the performer's task performance would result in physical or mental inconvenience.
2.0	The most serious likely error in the performer's task performance would result in very minor physical or mental harm, requiring little or no remediation.
3.0	The most serious likely error in the performer's task performance would result in minor physical or mental harm and would require remediation or treatment.
5.5	The most serious likely error in the performer's task performance would result in considerable physical or mental harm and would require remediation or treatment.
7.0	The most serious likely error in the performer's task performance would result in very serious physical or mental harm, or would put the affected person in danger of minor permanent damage.
8.0	The most serious likely error in the performer's task performance would result in serious permanent damage beyond the help of remediation or treatment.
9.0	The most serious likely error in the performer's task performance would result in immediate and inevitable death.

Scale 18. LEVELS OF KNOWLEDGE

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This scale refers to the level of knowledge in a given subject category required of the performer in the task being scaled. The knowledge category is rated with this scale. To be rated above zero on the scale the task must require knowledge beyond the simple memorization of the overt steps of the task.

The scale rises with the amount of detailed knowledge which must be consciously applied and with the depth of understanding required in the subject area, in terms of the subject area's content, the structure of its ideas, and its uses. "Detailed knowledge" covers such things as technical or special terms or facts. "Consciously applied" means that the performer is able to (but need not) articulate his use of the knowledge in the task situation.

The level of knowledge for a category is not determined by the level of any intellectual skills required, nor by the level for any other knowledge category required for the task, nor by the level of the category required for any other tasks of the job involved.

SCALE VALUE	DESCRIPTIVE STATEMENT
0.0	The task does not require the performer to consciously apply knowledge in this subject category which has been gained in a learning experience requiring more than the memorization of the overt steps of the specific task being scaled.
1.5	The task requires that the performer consciously apply a limited amount of detailed knowledge in this subject category, including such things as technical or special terms, facts or equipment.
2.5	The task requires that the performer have a general awareness of this subject category in terms of its content, the structure of its ideas, and its uses. The performer must consciously apply a limited amount of detailed knowledge in this subject area, including such things as technical or special terms, facts or equipment.
3.5	The task requires that the performer have a general awareness of this subject category in terms of its content, the structure of its ideas, and its uses. The performer must consciously apply a moderate amount of detailed knowledge in this subject area, including such things as technical or special terms, facts or equipment.

(continued on next page)

Scale 18. LEVELS OF KNOWLEDGE (continued)

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SCALE VALUE	DESCRIPTIVE STATEMENT
5.5	The task requires that the performer have a considerable degree of understanding of this subject category in terms of its content, the structure of its ideas, and its uses. The performer must consciously apply a moderate amount of detailed knowledge in this area, including such things as technical or special terms, facts or equipment.
7.0	The task requires that the performer have a considerable degree of understanding of this subject category in terms of its content, the structure of its ideas, and its uses. The performer must consciously apply a very great amount of detailed knowledge in this subject area, including such things as technical or special terms, facts or equipment.
8.0	The task requires that the performer have a very deep understanding of this subject category in terms of its content, the structure of its ideas, and its uses. The performer must consciously apply a moderate amount of detailed knowledge in this subject area, including such things as technical or special terms, facts or equipment.
9.0	The task requires that the performer have a very deep understanding of this subject category in terms of its content, the structure of its ideas, and its uses. The performer must consciously apply a very great amount of detailed knowledge in this subject area, including such things as technical or special terms, facts or equipment.

APPENDIX D

SKILL AND KNOWLEDGE REQUIREMENTS AND CURRICULUM OUTLINES

Table 9. Skills and Knowledges Required in Radiologic Technology, Ultrasound Technology, Radiation Therapy Technology and Related Functions by Function and Job Level. D-1

Table 10. Curriculum Outlines for Patient Care Aide and Technician Tasks To Service Diagnostic Ultrasound, Radiology and Radiation Therapy. D-15

Table 11. Curriculum Outlines for Quality Assurance - Materials Aide and Technician Tasks to Service Diagnostic Radiology, Radiation Therapy and Ultrasound. D-23

Table 12. Curriculum Outlines for Patient Care Technician and Diagnostic Ultrasound Technologist Tasks. D-31

Table 13. Curriculum Outlines for Radiation Therapy Technician and Radiation Therapy Technologist Tasks. D-43

Table 9. SKILLS AND KNOWLEDGES REQUIRED IN RADIOLOGIC TECHNOLOGY, ULTRASOUND TECHNOLOGY, RADIATION THERAPY TECHNOLOGY AND RELATED FUNCTIONS BY FUNCTION AND JOB LEVEL[a] p. 1 of 13

Skill, or Knowledge Category Number and Name	Scale Value	Patient Care		Radiology Quality Assurance, Materials			Radiation Therapy		Ultra-sound	Radi-ologic
		Aide 1	Techn. 2	Aide 1	Techn. 2	Physt. 5	Techn. 2	Tech. 3	Tech. 3	Tech. 3
Object Manipulation Skills	1.5	x	x	x	x		x	x	x	x
	3.5	x	x	x	x		x	x		x
	5.0		x	x						
	7.5		x							
Guiding or Steering Skills	1.5	x	x	x	x		x	x		x
	3.0	x	x						x	
	5.5								x	
Human Interaction Skills	1.0	x	x	x	x		x			x
	3.0	x	x	x	x	x	x	x		x
	5.0	x	x			x	x	x	x	x
	7.0		x					x		
Oral Use of a Relevant Language	2.0	x	x	x	x		x			
	4.0	x	x	x	x		x	x	x	x
	7.5	x	x			x		x		x
Reading Use of a Relevant Language	2.0	x	x	x	x	x	x	x		x
	5.0		x	x	x		x	x	x	x
	7.0					x				
Written Use of a Relevant Language	2.0	x	x	x	x	x	x	x		x
	5.0				x	x		x	x	

[a] Functions refer to the five task factors: radiologic technology, ultrasound, radiation therapy technology, quality assurance and materials, and patient care.
Numbers refer to job levels as follows: 1 = aide; 2 = technician; 3 = technologist; 5 = professional, in this case, radiation physicist. An "x" in a column means that at least one task in the group requires the skill or knowledge category at the scale value indicated. The HSMS scales for skills and knowledge are presented in Appendix A. The task content for each function and job level is presented in Appendix B.

Table 9. (continued)

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Skill, or Knowledge Category Number and Name	Scale Value	Patient Care		Radiology Quality Assurance, Materials			Radiation Therapy		Ultra-sound Tech. 3	Radi-ologic Tech. 3
		Aide 1	Techn. 2	Aide 1	Techn. 2	Physt. 5	Techn. 2	Tech. 3		
Decision Making on Methods	1.5	x	x	x	x		x			x
	3.0	x	x	x	x		x	x	x	x
	4.5	x	x		x	x		x	x	x
	7.0		x			x				
Decision Making on Quality	1.5	x	x							
	2.0	x	x	x			x			
	3.5	x	x	x	x		x	x		x
	5.5				x		x	x		x
	7.0	x	x		x	x	x	x	x	x
Figural Skills	1.0	x	x		x		x		x	x
	3.5				x	x	x	x		x
	5.0					x		x	x	x
Symbolic Skills	1.5			x	x		x	x	x	x
	3.5					x				
Taxonomic Skills	2.0		x		x	x	x	x	x	x
	5.5					x				
Implicative Skills	1.0	x	x	x	x	x	x	x		x
	2.0	x	x		x	x	x	x	x	x
	4.0					x		x	x	
	5.0		x						x	
Financial Consequences of Error	1.0	x	x	x	x	x	x	x	x	x
	4.0				x	x				x
Consequences of Error to Humans	1.0	x	x	x	x		x	x	x	
	2.0	x	x	x			x	x		x
	3.0	x	x	x	x				x	x
	5.5	x	x	x	x	x	x	x		x
	7.0	x	x		x	x	x			x

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Table 9. (continued)

Knowledge Category Number and Name	Scale Value	Patient Care		Radiology Quality Assurance, Materials			Radiation Therapy		Ultrasound Tech. 3	Radiologic Tech. 3
		Aide 1	Techn. 2	Aide 1	Techn. 2	Physt. 5	Techn. 2	Tech. 3		
11731000 Normal structure and function (human anatomy and physiology)	1.5							x		
	2.5							x	x	x
	3.5							x		
11731100 Regional anatomy (includes head and neck, thorax and abdomen, pelvis and perineum, lower and upper limbs, and skeleton)	1.5		x				x			
	2.5					x		x		x
	3.5				x		x	x	x	x
	5.5				x	x		x	x	x
11731200 Topographic anatomy (relation of external manifestations to internal structure and function)	1.5	x	x				x			x
	2.5	x	x				x	x	x	
	3.5		x				x	x	x	x
	5.5							x	x	x
11731300 Hematopoietic system (includes blood, red and white blood cells, platelets, and bone marrow, liver, and spleen in their blood forming function)	1.5									x
	2.5							x		
11731400 Circulatory system (cardiovascular system; includes heart veins, arteries, lymphatics)	1.5	x	x					x		x
	2.5		x					x	x	
	3.5								x	
11731500 Respiratory system	1.5							x		x
	2.5		x					x	x	
11731600 Digestive system	1.5							x		x
	2.5							x	x	
11731610 Mouth, pharynx (digestive function), esophagus (includes tongue, teeth, salivary glands)	1.5		x				x	x		x
	2.5							x		

Table 9. (continued)

Knowledge Category Number and Name	Scale Value	Patient Care		Radiology Quality Assurance, Materials			Radiation Therapy		Ultra-sound Tech. 3	Radi-ologic Tech. 3
		Aide 1	Techn. 2	Aide 1	Techn. 2	Physt. 5	Techn. 2	Tech. 3		
11731620 Stomach and small intestine (includes duodenum, jejunum, ileum)	1.5							x		x
	2.5								x	
11731630 Large intestine (colon) and rectum (includes appendix, anus, and mesentery)	1.5							x		x
	2.5		x						x	
11731640 Liver, biliary system, pancreas (includes gallbladder, cystic bile and pancreatic ducts, ampulla of Vater)	1.5							x		x
	2.5								x	
11731700 Urinary system (includes kidney, ureter, bladder, urethra, external genitalia)	1.5							x	x	x
	2.5		x					x	x	
	3.5		x							
11731800 Musculoskeletal system	1.5							x		
	2.5							x	x	x
	3.5							x		x
	5.5									x
11731810 Muscles	1.5							x		
	2.5							x		
11731820 Bones and joints (includes ligaments and tendons)	2.5							x		x
	3.5									x
11731831 Skin and sweat glands	1.5						x	x		
	2.5							x	x	
11731910 Central nervous system (brain and spinal cord)	1.5									x
	2.5							x	x	
11731943 Eye and optic nerve	1.5	x	x				x	x		x
11731945 The ear (excludes balance function)	1.5		x					x		

Table 9. (continued) p. 5 of 13

Knowledge Category Number and Name	Scale Value	Patient Care		Radiology Quality Assurance, Materials			Radiation Therapy		Ultra-sound Tech. 3	Radi-ologic Tech. 3
		Aide 1	Techn. 2	Aide 1	Techn. 2	Physt. 5	Techn. 2	Tech. 3		
11732210 Endocrine glands and their hormone physiology (includes pituitary, adrenal, thyroid, parathyroid, pineal, pancreas, ovary and testes in their endocrine functions)	1.5							x		
	2.5							x	x	
11732221 Conception, contraception	1.5								x	
11732222 Male reproductive system	1.5							x		x
	2.5							x		
11732223 Female reproductive system (includes body changes associated with ovulation, conception, pregnancy, development of placenta)	1.5		x					x	x	x
	2.5		x					x	x	
	3.5								x	
11733100 Infective and parasitic diseases	2.5								x	
11733200 Neoplasms (cancerous growths)	1.5		x					x		x
	2.5		x				x	x	x	
	3.5							x	x	
11733300 Endocrine, nutritional, and metabolic disorders	1.5								x	
	3.5								x	
11733400 Disorders of blood and blood-forming organs	1.5									x
	2.5							x	x	
11733510 Disorders of the central nervous system	1.5							x	x	x
	2.5							x		
	3.5								x	
11733600 Disorders of the circulatory system	1.5	x	x					x		x
	2.5							x	x	x
	3.5								x	

Table 9. (continued)

Knowledge Category Number and Name	Scale Value	Patient Care		Radiology Quality Assurance. Materials			Radiation Therapy		Ultra-sound Tech. 3	Radi-ologic Tech. 3
		Aide 1	Techn. 2	Aide 1	Techn. 2	Physt. 5	Techn. 2	Tech. 3		
11733700 Disorders of the digestive system	1.5		x					x		x
	2.5		x					x	x	
	3.5								x	
11733800 Disorders of the respiratory system	1.5							x		x
	2.5							x		x
	3.5								x	
11733900 Disorders of the urogenital system	1.5		x					x		x
	2.5							x		
	3.5								x	
11734100 Disorders of the skin and subcutaneous tissues	1.5		x					x	x	
	2.5							x		
11734200 Disorders of the musculoskeletal system,connective tissues	1.5							x		x
	2.5							x		x
11734300 Congenital abnormalities	1.5									x
	3.5								x	
11734400 Disorders and complications of pregnancy, childbirth and the puerperium	1.5									x
	2.5								x	
	3.5								x	
11734500 Perinatal morbidity and mortality	2.5								x	
11734600 Burns	3.5		x							
11734800 Shock and trauma	1.5									x
	2.5							x	x	x
	3.5		x							
11735000 Surgery	1.5							x		x
11735100 Operative procedures (also includes biopsy, removal of tumors, organs, drains)	1.5		x					x	x	x
11735300 Repair surgery	1.5									x

Table 9. (continued)

Knowledge Category Number and Name	Scale Value	Patient Care		Radiology Quality Assurance, Materials			Radiation Therapy		Ultra-sound Tech.	Radi-ologic Tech.
		Aide 1	Techn. 2	Aide 1	Techn. 2	Physt. 5	Techn. 2	Tech. 3	3	3
11735400 Introductory procedures (includes injections, transfusion, irrigation, catheterization, intubation, tracheotomy)	1.5		x	x	x			x	x	x
	2.5		x					x		x
	3.5		x							
11735500 Endoscopy	1.5									x
11735600 Suture (also includes ligature, suture materials)	1.5		x							
11735800 Delivery methods for childbirth	1.5								x	x
11736000 Anesthesiology	1.5		x					x		x
11737000 First aid and care	2.5									x
	3.5							x	x	x
	7.0		x							
11737100 Bandages, dressings, tourniquets and splints	1.5	x	x					x		x
	2.5		x							
	3.5		x							
11737200 Hemorrhage and bleeding and their arrest	1.5	x	x					x		
	3.5		x							
11737300 Handling and transportation of the sick or wounded	1.5	x								
	2.5	x	x							x
	3.5	x	x				x	x		x
	5.5		x				x	x	x	x
11737400 Sprains, strains, fractures and their healing	1.5									x
	2.5									x
	3.5		x							
11737600 Resuscitation	7.0		x							
11737700 Wounds and their healing (also includes operative incisions)	1.5		x				x			x
	2.5		x							x
	3.5		x							
	5.5		x							

Table 9. (continued) p. 8 of 13

Knowledge Category Number and Name	Scale Value	Patient Care		Radiology Quality Assurance, Materials			Radiation Therapy		Ultra-sound Tech. 3	Radi-ologic Tech. 3
		Aide 1	Techn. 2	Aide 1	Techn. 2	Physt. 5	Techn. 2	Tech. 3		
11738000 Asepsis (concepts and techniques involved in achievement of sterile condition; includes concurrent and terminal disinfection during surgery, aspects of sterilization of implements and equipment such as autoclaving)	1.5	x	x	x	x					
	2.5	x	x	x			x	x	x	x
	3.5	x	x							x
11744000 Dentistry	1.5							x		
11744200 Oral surgery (surgical and adjunctive treatment of diseases, injuries and defects of the mouth, the jaws, and associated structures)	1.5						x	x		
11745000 Growth and development	1.5								x	
	2.5								x	
11745100 Embryology and prenatal period growth and development	1.5								x	
	2.5								x	
11745200 Neonatal period growth and development	2.5								x	
12210000 Radiobiology (effects of high energy radiation on living organisms; includes effects of ionizing electromagnetic, ultraviolet, sonic and particulate radiation, biological safety requirements and protection)	1.5	x	x		x		x			
	2.5		x		x	x	x	x		x
	3.5		x		x	x	x			x
	5.5					x		x		
12220000 Radiology (diagnostic and therapeutic application of radiant energy)	2.5					x				

Table 9. (continued)

Knowledge Category Number and Name	Scale Value	Patient Care		Radiology Quality Assurance, Materials			Radiation Therapy		Ultra-sound Tech. 3	Radi-ologic Tech. 3
		Aide 1	Techn. 2	Aide 1	Techn. 2	Physt. 5	Techn. 2	Tech. 3		
12221000 Radiotherapy (application of electromagnetic and particulate ionizing radiation to living organisms for therapeutic purposes; includes determination of course of treatment and administration of treatment)	1.5		x				x			
	2.5	x	x			x	x	x		
	3.5						x	x		
	5.5							x		
	7.0							x		
12222000 Radionuclide therapy (part of nuclear medicine; internal application of unsealed sources of particulate radiation (radioactive materials) to living organisms for therapeutic purposes)	1.5							x		
	2.5					x		x		
12223000 Diagnostic radiography (application of electromagnetic ionizing radiation such as x-rays to achieve interpretable images for diagnostic purposes; also includes fluoroscopy, use of related techniques, contrast media, procedures, positioning, interpretation of images)	1.5		x	x	x		x			
	2.5	x	x		x			x	x	x
	3.5				x	x	x	x		x
	5.5				x	x		x		x
	7.0					x				x
12224000 Radionuclide analysis (part of nuclear medicine; internal application of unsealed radioactive nuclides to living organisms for diagnosis or investigation; includes use of radioisotope scanning, related procedures.	1.5								x	
	2.5					x				

Table 9. (continued)

Knowledge Category Number and Name	Scale Value	Patient Care		Radiology Quality Assurance, Materials			Radiation Therapy		Ultra-sound Tech. 3	Radi-ologic Tech. 3
		Aide 1	Techn. 2	Aide 1	Techn. 2	Physt. 5	Techn. 2	Tech. 3		
12300000 Pharmacology (the study of drugs)	1.5		x	x	x			x		
12331000 Drug toxicity (includes antidotal therapy)	2.5		x							
12332000 Drug idiosyncrasy and allergy pharmacogenetics	1.5							x		x
	2.5		x							
12334000 Drug tolerance and physical dependence	2.5		x							
12335000 Drug synergism	2.5		x							
12336000 Chemical teratogenesis	2.5		x							
12341100 Antibacterial and antifungal chemotherapy	1.5		x					x		
	2.5		x							
	3.5		x							
12341300 Cancer and virus chemotherapy	1.5							x		
	2.5		x							
	3.5		x							
12342100 Drugs acting on the cardiovascular system and smooth muscle	1.5		x							
	2.5		x							
	3.5		x							
12342200 Drugs acting on the blood	2.5		x							
	3.5		x							
12342300 Hormones and drugs acting on endocrine glands and accessory reproductive organs	2.5		x							
	3.5		x							
12342600 Drugs for allergy, cough, vomiting, dermatomucosal surfaces	2.5		x							
	3.5		x							
12342700 Drugs acting on the gastrointestinal tract	2.5		x							
	3.5		x							

Table 9. (continued)

Knowledge Category Number and Name	Scale Value	Patient Care		Radiology Quality Assurance, Materials			Radiation Therapy		Ultra-sound	Radi-ologic
		Aide 1	Techn. 2	Aide 1	Techn. 2	Physt. 5	Techn. 2	Tech. 3	Tech. 3	Tech. 3
12342810 Drugs acting on the autonomic nervous system	2.5		x							
	3.5		x							
12342820 Drugs acting on the neuromuscular system	2.5		x							
	3.5		x							
12342830 Drugs acting on the central nervous system	1.5									x
	2.5		x							
	3.5		x							
12342900 Drugs acting on the immunologic system	2.5		x							
	3.5		x							
13322000 Properties of lead	1.5							x		
13323000 Properties of the alkali metals (includes lithium, potassium, sodium, rubidium, cesium, francium)	1.5							x		
13332000 Properties of iron, cobalt, nickel	1.5							x		
14111000 Solutions (mechanical, optical, colligative properties)	1.5							x		
	2.5					x				
15212100 Electric circuit theory (includes Ohm's law, Kirchhoff's laws, impedance, inductance, resistance, amperage, voltage, potentiometry, bridges, alternating and direct current, wave-guides, transmission)	1.5				x	x				
	2.5					x				
15214100 Acoustics (includes sound, compression waves, sound propagation, Doppler effect)	1.5								x	

Table 9. (continued)

Knowledge Category Number and Name	Scale Value	Patient Care		Radiology Quality Assurance, Materials			Radiation Therapy		Ultra-sound Tech. 3	Radi-ologic Tech. 3
		Aide 1	Techn. 2	Aide 1	Techn. 2	Physt. 5	Techn. 2	Tech. 3		
15222100 Atomic structure	2.5					x				
15222200 Atomic radiation processes	2.5					x				
15222500 Interaction with radiation (includes the properties and behavior of electromagnetic ionizing radiation in interaction with living tissue and other matter, scattering, the attenuating properties of materials, inversion spectra-absorption of microwave radiation)	1.5		x		x	x	x	x		x
	2.5					x		x		
	3.5							x		
24110000 Electromagnetic field theory applications (includes electromagnetic devices and energy conversion)	1.5				x	x				
24112000 Transducers and rotating machines	1.5				x				x	
	2.5					x				
24121000 Acoustic properties of materials (includes impedance, absorption)	1.5				x				x	
24124000 Ultrasonics	2.5	x								
	3.5				x					
	5.5								x	
	7.0								x	
24132100 Electronic devices	1.5				x	x				
	2.5					x				
25500000 Casting (includes foundry casting, mold design, injection casting, pattern design)	1.5						x	x		
	2.5							x		

Table 9 (continued)

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Knowledge Category Number and Name	Scale Value	Patient Care		Radiology Quality Assurance, Materials			Radiation Therapy		Ultra-sound	Radi-ologic
		Aide 1	Techn. 2	Aide 1	Techn. 2	Physt. 5	Techn. 2	Tech. 3	Tech. 3	Tech. 3
25600000 Tools and dies (includes design of tools to cut and shape material)	1.5						x	x		
25700000 Fabrication selection (application of machine tools, cutting and joining of materials, material selection)	1.5							x		
33000000 Computer technology	1.5			x	x					x
	2.5					x				
36220000 Processed metals (raw materials or fabricated)	1.5						x	x		
36800000 Stone, marble, gems	1.5						x	x		
37100000 Concrete, gypsum and plaster	1.5						x	x		
37700000 Plastics	1.5						x			
	2.5							x		
41666700 Death and dying behavioral development	1.5		x				x	x		x
51200000 Algebra	1.5				x	x	x	x		x
52220000 Descriptive statistics	1.5				x	x				
65260000 Photography and cinematography	1.5				x	x				
	2.5					x				
65620000 Mechanics of writing English (includes traditional grammar, punctuation, spelling, bibliographic and footnote form)	1.5	x	x		x	x	x	x		
	2.5		x					x	x	x
	3.5				x	x			x	
	5.5					x				
Total skill and knowledge categories:	124	25	65	17	32	32	36	81	60	66

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Table 10. CURRICULUM OUTLINES FOR PATIENT CARE AIDE AND TECHNICIAN TASKS TO SERVICE DIAGNOSTIC ULTRASOUND, RADIOLOGY AND RADIATION THERAPY

p. 1 of 8

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 1 Aide Tasks	Level 2 Technician Tasks
Object Manipulation Skills	1.5	98 153 166 195 199 262 283 292 301 302 303 520 521	198 298 308 522 578 579 620
	3.5	287 290	156 182 185 194 243
	5.0		18 33 65 133 296 299 577
	7.5		143 181
Guiding or Steering Skills	1.5	287 302	620
	3.0	190	182 185
Human Interaction Skills	1.0	166 190 199 278 279 281 291	65
	3.0	74 98 113 116 155 193 195 262 271 282 283 287 289 292 301 302 303 520 521 611	18 33 133 156 194 198 280 298 299 308 522
	5.0	73 138 153 290 490 633	143 159 181 182 185 243 577 578 579
	7.0		296 610 616 618 620

Note: Task descriptions appear in Research Report No. 7, Volume 3 and Research Report No. 9; abbreviated task names are listed in Table 1 and the tables in Appendix B. Full knowledge category names are in Table 9. HSMS scales are in Appendix C.

Table 10. PATIENT CARE (continued) p. 2 of 8

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 1 Aide Tasks	Level 2 Technician Tasks
Leadership Skills[a]	1.0		33
	4.5		296
Oral Use of a Relevant Language	2.0	166 190 195 271 279 281 283 287 289 291 490	308
	4.0	73 74 98 113 116 138 153 155 193 199 262 278 282 290 292 302 303 520 521 633	18 33 65 133 143 156 159 181 182 185 194 198 243 280 296 298 299 522 577 578
	7.5	611	579 610 616 618 620
Reading Use of a Relevant Language	2.0	74 98 116 153 155 166 190 193 199 262 278 279 281 287 289 290 301 302 303 520 611 633	18 65 133 143 156 159 181 182 185 194 198 296 298 299 308 522 577 578 579 618 620
	5.0		33 280
Written Use of a Relevant Language	2.0	116 195 278 279	33 156 159 181 243 522 620

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[a] Leadership skill requirements are largely determined by institutional circumstances and arrangements rather than the intrinsic nature of tasks. They were omitted from Table 9 but are included here.

Table 10. PATIENT CARE (continued) p. 3 of 8

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 1 Aide Tasks	Level 2 Technician Tasks
Decision Making on Methods	1.5	98 116 195 199 262 279 281 282 283 287 490 520 521	143 181 194 298 577 578 620
	3.0	155 166 190 193 278 303 611	18 33 65 133 156 159 182 185 243 299 308 579
	4.5	73 113 138 290 633	610 616 618
	7.0		296
Decision Making on Quality	1.5	153	198
	2.0	193 199	308
	3.5	116 166 195 262 278 281 282 283 290 291 292 302 303 490 520 521	18 33 65 280 298 522
	7.0	73 74 113 138 190 287 289 301 611 633	133 143 156 159 181 182 185 194 243 296 299 577 578 579 610 616 618 620
Figural Skills	1.0	262 271	308
Taxonomic Skills	2.0		296
Implicative Skills	1.0	116 262 271 283	33 65 133 143 156 159 181 182 185 299 308 579
	2.0	73 633	280 610 616 618
	5.0		296

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 1 Aide Tasks	Level 2 Technician Tasks
Financial Consequences of Error	1.0	73 74 98 113 116 138 153 155 166 195 199 262 271 278 282 283 287 289 290 291 303 611 633	18 33 65 133 143 156 159 181 185 194 198 280 296 298 299 308 522 577 578 579 610 616 618 620
Consequences of Error To Humans	1.0	73 74 98 113 116 155 199 262 278 279 281 287 290 291 302 303 520 611 633	133 159 198 610 616 618 620
	2.0	193 195 283 289 292 301 490	18 156 182 194 578
	3.0	138 153 166	33 143 181 185 243 579
	5.5	190 282 521	65 280 296 298 299 522 577
	7.0	271	308
11731100 Regional anatomy	1.5		620
11731200 Topographic anatomy	1.5	199 262 520	18 308
	2.5	193	578
	3.5		133 296 299
11731400 Circulatory system	1.5	262 520	18 308
	2.5		296
11731500 Respiratory system	2.5		296
11731610 Mouth, pharynx, esophagus	1.5		620
11731630 Large intestine (colon) and rectum	2.5		579

Table 10. PATIENT CARE (continued) p. 5 of 8

Abbreviated Name of Skill or Knowledge Category		Scale Value	Level 1 Aide Tasks	Level 2 Technician Tasks
11731700	Urinary system	2.5		143 578
		3.5		181
11731943	Eye and optic nerve	1.5	195	194 577
11731945	The ear	1.5		194
11732223	Female reproductive system	1.5		620
		2.5		578
11733200	Neoplasms (cancerous growths)	1.5		578
		2.5		579 618 620
11733600	Disorders of the circulatory system	1.5	199 262 520	308
11733700	Disorders of the digestive system	1.5		618
		2.5		579
11733900	Disorders of the uro-genital system	1.5		618
11734100	Disorders of skin, subcutaneous tissues	1.5		618
11734600	Burns	3.5		156
11734800	Shock and trauma	3.5		296
11735100	Operative procedures	1.5		65
11735400	Introductory procedures	1.5		18 65 182 616
		2.5		143 181 578 579 620
		3.5		133 296 299
11735600	Suture	1.5		33
11736000	Anesthesiology	1.5		577 579
11737000	First aid and care	7.0		296
11737100	Bandages, dressings, tourniquets, splints	1.5	195 283	33 522
		2.5		156
		3.5		296

Table 10. PATIENT CARE (continued)

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 1 Aide Tasks	Level 2 Technician Tasks
11737200 Hemorrhage and bleeding and their arrest	1.5	521	522
	3.5		296
11737300 Handling, transportation of the sick or wounded	1.5	153 155	
	2.5	116 166 190 282	243
	3.5	193 199 283 490	156 577 578 579 620
	5.5		296
11737400 Sprains, strains, fractures, and their healing	3.5		296
11737600 Resuscitation	7.0		296
11737700 Wounds and their healing	1.5		522
	2.5		296
	3.5		156
	5.5		33
1173800 Asepsis	1.5	193 290	18 194
	2.5	153 283 521	33 522 577 578 618 620
	3.5	166 490 520	65 133 143 156 181 296 299 308
12210000 Radiobiology	1.5	520	308 610 616
	2.5		280 618 620
	3.5		577
12221000 Radiotherapy	1.5		620
	2.5	611	159 577 578 579 610 616 618
12223000 Diagnostic radiography	1.5		610 616
	2.5	73 74	65
12300000 Pharmacology	1.5		133 198 298 299 618

Table 10. PATIENT CARE (continued) p. 7 of 8

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 1 Aide Tasks	Level 2 Technician Tasks
12331000 Drug toxicity, antidotal therapy	2.5		133 198 298 299
12332000 Drug idiosyncrasy, allergy pharmacogenetics	2.5		33 133 198 298 299
12334000 Drug tolerance and physical dependence	2.5		133 299
12335000 Drug synergism	2.5		133 198 298 299
12336000 Chemical teratogenesis	2.5		133 299
12341100 Antibacterial and antifungal chemotherapy	1.5		577 578
	2.5		198 298
	3.5		33 133 299
12341300 Cancer and virus chemotherapy	2.5		198 298
	3.5		133 299
12342100 Drugs acting on the cardiovascular system and smooth muscle	1.5		296
	2.5		198 298
	3.5		133 299
12342200 Drugs acting on the blood	2.5		198 298
	3.5		133 299
12342300 Hormones and drugs acting on endocrine glands, accessory reproductive organs	2.5		198 298
	3.5		133 299
12342600 Drugs for allergy, cough, vomiting	2.5		198 298
	3.5		133 299
12342700 Drugs acting on gastrointestinal tract	2.5		198 298
	3.5		133 299
12342810 Drugs acting on autonomic nervous system	2.5		198 298
	3.5		133 299
12342820 Drugs acting on the neuromuscular system	2.5		198 298
	3.5		133 299
12342830 Drugs acting on the central nervous system	2.5		198 298
	3.5		133 299

Table 10. PATIENT CARE (continued) p. 8 of 8

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 1 Aide Tasks	Level 2 Technician Tasks
12342900 Drugs acting on the immunologic system	2.5		198 298
	3.5		133 299
15222500 Interaction with radiation	1.5		280
24124000 Ultrasonics	2.5	633	
41666700 Death and dying behavioral development	1.5		610 616 618 620
65620000 Mechanics of writing English	1.5	116	33 156 182
	2.5		159 620

Table 11. CURRICULUM OUTLINES FOR QUALITY ASSURANCE-MATERIALS AIDE AND TECHNICIAN TASKS TO SERVICE DIAGNOSTIC RADIOLOGY, RADIATION THERAPY AND ULTRASOUND

p. 1 of 8

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 1 Aide Tasks	Level 2 Technician Tasks
Object Manipulation Skills	1.5	71 79 145 167 192 260 267 273 319 632	178 304 524 525 527 529 530 531 532 534 535 536 537 538 539 545 548 550 621 639
	3.5	72 95 180 269 275 284 551 552	173 175 187 276 543 544 553
	5.0	69	
Guiding or Steering Skills	1.5	136 288	524 621 639
Human Interaction Skills	1.0	8 69 70 71 72 79 80 95 134 135 136 137 151 163 164 180 184 227 260 267 269 274 275 284 285 286 288 297 300 354 552 632	78 173 178 187 276 304 523 524 525 527 534 536 538 553 554 556 639
	3.0	76 128 129 145 192	147 175 280 529 530 531 532 533 535 537 539 540 543 544 545 548 549 550

Note: Task descriptions appear in Research Report No. 7, Volume 3 and Research Report No. 9; abbreviated task names are listed in Table 1 and the tables in Appendix B. Full knowledge category names are in Table 9. HSMS scales are in Appendix C.

Table 11. QUALITY ASSURANCE-MATERIALS (continued) p. 2 of 8

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 1 Aide Tasks	Level 2 Technician Tasks
Oral Use of a Relevant Language	2.0	8 69 70 71 76 79 80 95 128 129 134 135 136 137 145 151 163 164 184 227 260 273 275 284 285 286 288 297 300 354 552 632	78 173 178 187 276 304 523 524 525 534 536 538 553 554 556 639
	4.0	192	147 175 280 527 529 530 531 532 533 535 537 539 540 543 544 545 548 549 550
Reading Use of a Relevant Language	2.0	69 71 72 76 79 80 95 128 129 134 135 136 137 163 164 180 192 222 227 260 264 265 267 269 274 275 284 285 286 288 300 354	78 147 175 178 187 304 534 621 639
	5.0	8 70 273	276 280 523 524 525 527 529 530 531 532 533 535 537 538 539 540 543 544 545 548 549 550 553 554 556

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 1 Aide Tasks	Level 2 Technician Tasks
Written Use of a Relevant Language	2.0	134	173 175 178 187 276 525 529 530 531 532 533 534 535 536 537 538 539 540 543 544 545 548 549 556 621 639
	5.0		550 554
Decision Making on Methods	1.5	8 69 70 72 79 134 145 151 163 164 167 192 223 267 297 552 632	523
	3.0	71 76 80 95 135 136 184 227 273 274 275 284 300 354	78 147 173 175 178 187 304 524 527 533 536 538 553 554 621 639
	4.5		276 525 529 330 531 532 534 535 537 539 540 543 544 545 548 549 550 556

Table 11. QUALITY ASSURANCE-MATERIALS (continued) p. 4 of 8

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 1 Aide Tasks	Level 2 Technician Tasks
Decision Making on Quality	2.0	275 297 632	
	3.5	8 70 71 72 76 80 95 128 129 134 135 151 167 192 223 227 260 269 273 284 286 319 354 551 552	78 147 173 175 178 187 276 280 304 523 524 534 536 538 554 639
	5.5		621
	7.0		525 527 529 530 531 532 533 535 537 539 540 543 544 545 548 549 550 553 556
Figural Skills	1.0		78 175 524 527 529 530 531 532 533 534 535 536 538 539 540 544 548 549
	3.5		525 537 545 550 639
Symbolic Skills	1.5	134	147 173 175 525 529 530 531 532 535 536 537 538 539 543 544 548 549 550 553 556 639

Table 11. QUALITY ASSURANCE-MATERIALS (continued) p. 5 of 8

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 1 Aide Tasks	Level 2 Technician Tasks
Taxonomic Skills	2.0		525 543 550
Implicative Skills	1.0	8 70 275 354	173 175 178 523 527 529 530 531 532 533 535 537 538 539 540 543 544 545 548 549 556 639
	2.0		78 276 280 524 525 550
Financial Consequences of Error	1.0	8 69 70 71 72 76 79 80 95 129 134 135 136 137 145 151 163 164 167 180 192 222 227 260 265 267 269 273 274 275 284 285 286 288 297 319 354 551 552 632	78 173 280 304 523 524 525 527 529 530 531 532 533 534 536 537 538 539 540 543 544 545 548 549 550 553 554 556 621 639
	4.0		147 175 178 276 535

Table 11. QUALITY ASSURANCE-MATERIALS (continued) p. 6 of 8

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 1 Aide Tasks	Level 2 Technician Tasks
Consequences of Error To Humans	1.0	8 72 76 95 128 129 134 135 136 145 151 163 164 167 184 222 223 227 260 264 265 267 269 274 275 284 285 286 288 297 300 354 632	78 147 173 175 187 639
	2.0	137 180 319	
	3.0	70 79	276 527 529 530 534 549
	5.5	69 71 80 192 273 551 552	178 280 304 523 524 525 531 532 533 536 537 538 539 544 553 554 556
	7.0		535 540 543 545 548 550 621
11731100 Regional anatomy	3.5		78 527
	5.5		545
11735400 Introductory procedures	1.5	260	304
11738000 Asepsis	1.5	151 180 260	304
	2.5	79 80	

Table 11. QUALITY ASSURANCE-MATERIALS (continued) p. 7 of 8

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 1 Aide Tasks	Level 2 Technician Tasks
12210000 Radiobiology	1.5		173 175 178 187 523 524 525 536 538 553 554
	2.5		280 529 530 531 532 533 534 535 537 539 540 543 544 548 549 550 556
	3.5		545 621
12223000 Diagnostic radiography	1.5	8 275	523 524
	2.5		78 147 178 187 525 527 536
	3.5		173 175 529 530 531 532 533 534 535 537 538 539 540 543 544 548 549 550 553 556
	5.5		545
12300000 Pharmacology	1.5	260	304
15212100 Electric circuit theory	1.5		532 535 536 543 556

Table 11. QUALITY ASSURANCE-MATERIALS (continued) p. 8 of 8

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 1 Aide Tasks	Level 2 Technician Tasks
15222500 Interaction with radiation	1.5		173 175 178 187 280 529 530 531 532 533 534 535 537 538 539 540 543 544 545 548 549 550 556 621
24110000 Electromagnetic field theory applications	1.5		535
24112000 Transducers and rotating machines	1.5		639
24121000 Acoustic properties of materials	1.5		639
24124000 Ultrasonics	3.5		639
24132100 Electronic devices	1.5		532 535 545 548 549 550 556
33000000 Computer technology	1.5	8	523 525 527
51200000 Algebra	1.5		173 529 530 531 535 639
52220000 Descriptive statistics	1.5		535 538 543 544 553 639
65260000 Photography and cinematography	1.5		543
65620000 Mechanics of writing English	1.5		173 175 178 187 525 529 530 531 532 533 534 535 536 537 538 539 540 543 544 545 548 549 550 556 621 639
	3.5		554

Table 12. CURRICULUM OUTLINES FOR PATIENT CARE TECHNICIAN AND DIAGNOSTIC ULTRASOUND TECHNOLOGIST TASKS

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Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
Object Manipulation Skills	1.5	198 298 308 522 578 579 620	623 624 625 626 627 628 629 630 631 634 635 636 637 638
	3.5	156 182 185 194 243	
	5.0	18 33 65 133 296 299 577	
	7.5	143 181	
Guiding or Steering Skills	1.5	620	
	3.0	182 185	628 637 638
	5.5		623 624 625 626 627 629 630 631 634 635 636
Human Interaction Skills	1.0	65	
	3.0	18 33 133 156 194 198 280 298 299 308 522	
	5.0	143 159 181 182 185 243 577 578 579	623 624 625 626 627 628 629 630 631 634 635 636 637 638
	7.0	296 610 616 618 620	

Note: Task descriptions appear in Research Report No. 9; abbreviated task names are listed in Table 1 and the tables in Appendix B. Full knowledge category names are in Table 9. HSMS scales are in Appendix C.

Table 12. DIAGNOSTIC ULTRASOUND (continued) p. 2 of 11

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
Oral Use of a Relevant Language	2.0	308	
	4.0	18 33 65 133 143 156 159 181 182 185 194 198 243 280 296 298 299 522 577 578	623 624 625 626 627 628 629 630 631 634 635 636 637 638
	7.5	579 610 616 618 620	
Reading Use of a Relevant Language	2.0	18 65 133 143 156 159 181 182 185 194 198 296 298 299 308 522 577 578 579 618 620	623 624 625 626 627 628 629 630 631 634 635 636 637 638
	5.0	33 280	
Written Use of a Relevant Language	2.0	33 156 159 181 243 522 620	
	5.0		623 624 625 626 627 628 629 630 631 634 635 636 637 638

Table 12. DIAGNOSTIC ULTRASOUND (continued) p. 3 of 11

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
Decision Making on Methods	1.5	143 181 194 298 577 578 620	
	3.0	18 33 65 133 156 159 182 185 243 299 308 579	637 638
	4.5	610 616 618	623 624 625 626 627 628 629 630 631 634 635 636
	7.0	296	
Decision Making on Quality	1.5	198	
	2.0	308	
	3.5	18 33 65 280 298 522	
	7.0	133 143 156 159 181 182 185 194 243 296 299 577 578 579 610 616 618 620	623 624 625 626 627 628 629 630 631 634 635 636 637 638
Figural Skills	1.0	308	637 638
	5.0		623 624 625 626 627 628 629 630 631 634 635 636
Symbolic Skills	1.5		623 624 625 626 627 628 629 630 631 634 635 636 637 638

Table 12. DIAGNOSTIC ULTRASOUND (continued) p. 4 of 11

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
Taxonomic Skills	2.0	296	623 624 625 626 627 628 629 630 631 634 635 636 637 638
Implicative Skills	1.0	33 65 133 143 156 159 181 182 185 299 308 579	
	2.0	280 610 616 618	637 638
	4.0		623 624 626 628 629 630 631 634 635 636
	5.0	296	625 627
Financial Consequences of Error	1.0	18 33 65 133 143 156 159 181 185 194 198 280 296 298 299 308 522 577 578 579 610 616 618 620	623 624 625 626 627 628 629 630 631 634 635 636 637 638
Consequences of Error to Humans	1.0	133 159 198 610 616 618 620	638
	2.0	18 156 182 194 578	
	3.0	33 143 181 185 243 579	623 624 625 626 627 628 629 630 631 634 635 636 637
	5.5	65 280 296 298 299 522 577	
	7.0	308	

Table 12. DIAGNOSTIC ULTRASOUND (continued) p. 5 of 11

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
11731000 Normal structure and function	2.5		623 624 625 626 627 628 629 630 631 634 635 636 637 638
11731100 Regional anatomy	1.5	620	
	3.5		626 630 634 635 636 637 638
	5.5		623 624 625 627 628 629 631
11731200 Topographic anatomy	1.5	18 308	
	2.5	578	637 638
	3.5	133 296 299	626 628 630 634 635
	5.5		623 624 625 627 629 631 636
11731400 Circulatory system	1.5	18 308	
	2.5	296	627 629 630 634 636 637 638
	3.5		635
11731500 Respiratory system	2.5	296	627 629 635
11731600 Digestive system	2.5		625 629
11731610 Mouth, pharynx, esophagus	1.5	620	
11731620 Stomach and small intestine	2.5		625
11731630 Large intestine (colon) and rectum	2.5	579	625
11731640 Liver, biliary system, and pancreas	2.5		625
11731700 Urinary system	1.5		623 624 636 637
	2.5	143 578	625 626 631
	3.5	181	

Table 12. DIAGNOSTIC ULTRASOUND (continued) p. 6 of 11

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
11731800 Musculoskeletal system	2.5		623 624 625 626 627 629 630 631 634 635 636 637
11731831 Skin and sweat glands	2.5		628
11731910 Central nervous system	2.5		628 630 631
11731943 Eye and optic nerve	1.5	194 577	
11731945 The ear	1.5	194	
11732210 Endocrine glands and hormone physiology	2.5		625 628
11732221 Conception and contraception	1.5		624
11732223 Female reproductive system	1.5	620	637
	2.5	578	623 631 636
	3.5		624
11733100 Infective and parasitic diseases	2.5		627
11733200 Neoplasms (cancerous growths)	1.5	578	
	2.5	579 618 620	623
	3.5		624 625 626 627 628 630
11733300 Endocrine, nutritional, metabolic disorders	1.5		628
	3.5		625
11733400 Disorders of blood, blood-forming organs	2.5		625
11733510 Disorders of central nervous system	1.5		628
	3.5		630 631
11733600 Disorders of the circulatory system	1.5	308	
	2.5		637
	3.5		627 629 630 634 635 636 638

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Table 12. DIAGNOSTIC ULTRASOUND (continued) p. 7 of 11

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
11733700 Disorders of the digestive system	1.5	618	
	2.5	579	625
	3.5		629
11733800 Disorders of the respiratory system	3.5		627 629 635
11733900 Disorders of the uro-genital system	1.5	618	
	3.5		623 624 626 631
11734100 Disorders of skin, subcutaneous tissues	1.5	618	628
11734300 Congenital abnormalities	3.5		623 631 636 637 638
11734400 Disorders, complications of pregnancy, birth	2.5		637
	3.5		623 631 636 637 636
11734500 Perinatal morbidity and mortality	2.5		623 631 634 635 638
11734600 Burns	3.5	156	
11734800 Shock and trauma	2.5		630
	3.5	296	
11735100 Operative procedures	1.5	65	626 628 630
11735400 Introductory procedures	1.5	18 65 182 616	630
	2.5	143 181 578 579 620	
	3.5	133 296 299	
11735600 Suture	1.5	33	
11735800 Delivery methods for childbirth	1.5		623 631 636 637
11736000 Anesthesiology	1.5	577 579	

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
11737000 First aid and care	3.5		623 624 625 626 627 628 629 630 631 634 635 636 637 638
	7.0	296	
11737100 Bandages, dressings, tourniquets, splints	1.5	33 522	
	2.5	156	
	3.5	296	
11737200 Hemorrhage and bleeding and their arrest	1.5	522	
	3.5	296	
11737300 Handling, transportation of the sick or wounded	2.5	243	
	3.5	156 577 578 579 620	
	5.5	296	623 624 625 626 627 628 629 630 631 634 635 636 637 638
11737400 Sprains, strains, fractures, and their healing	3.5	296	
11737600 Resuscitation	7.0	296	
11737700 Wounds and their healing	1.5	522	
	2.5	296	
	3.5	156	
	5.5	33	

Table 12. DIAGNOSTIC ULTRASOUND (continued) p. 9 of 11

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
11738000 Asepsis	1.5	18 194	
	2.5	33 522 577 578 618 620	623 624 625 626 627 628 629 630 631 634 635 636 637 638
	3.5	65 133 143 156 181 296 299 308	
11745000 Growth and development	1.5		626
	2.5		634 635 638
11745100 Embryology, prenatal growth, development	1.5		624
	2.5		623 631 636 637
11745200 Neonatal period growth, development	2.5		638
12210000 Radiobiology	1.5	308 610 616	
	2.5	280 618 620	
	3.5	577	
12221000 Radiotherapy	1.5	620	
	2.5	159 577 578 579 610 616 618	
12223000 Diagnostic radiography	1.5	610 616	
	2.5	65	623 624 625 626 627 628 629 630 631 634 635 636
12224000 Radionuclide analysis	1.5		623 624 625 626 627 628 629 630
12300000 Pharmacology	1.5	133 198 298 299 618	
12331000 Drug toxicity, antidotal therapy	2.5	133 198 298 299	

Table 12. DIAGNOSTIC ULTRASOUND (continued) p. 10 of 11

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
12332000 Drug idiosyncrasy, allergy pharmacogenetics	2.5	33 133 198 298 299	
12334000 Drug tolerance and physical dependence	2.5	133 299	
12335000 Drug synergism	2.5	133 198 298 299	
12336000 Chemical teratogenesis	2.5	133 299	
12341100 Antibacterial and antifungal chemotherapy	1.5	577 578	
	2.5	198 298	
	3.5	33 133 299	
12341300 Cancer and virus chemotherapy	2.5	198 298	
	3.5	133 299	
12342100 Drugs acting on the cardiovascular system and smooth muscle	1.5	296	
	2.5	198 298	
	3.5	133 299	
12342200 Drugs acting on the blood	2.5	198 298	
	3.5	133 299	
12342300 Hormones and drugs acting on endocrine glands, accessory reproductive organs	2.5	198 298	
	3.5	133 299	
12342600 Drugs for allergy, cough, vomiting	2.5	198 298	
	3.5	133 299	
12342700 Drugs acting on gastrointestinal tract	2.5	198 298	
	3.5	133 299	
12342810 Drugs acting on autonomic nervous system	2.5	198 298	
	3.5	133 299	
12342820 Drugs acting on the neuromuscular system	2.5	198 298	
	3.5	133 299	
12342830 Drugs acting on the central nervous system	2.5	198 298	
	3.5	133 299	

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
12342900 Drugs acting on the immunologic system	2.5	198 298	
	3.5	133 299	
15214100 Acoustics	1.5		637 638
15222500 Interaction with radiation	1.5	280	
24112000 Transducers and rotating machines	1.5		623 624 625 626 627 628 629 630 631 634 635 636 637 638
24121000 Acoustic properties of materials	1.5		623 624 625 626 627 628 629 630 631 634 635 636 637 638
24124000 Ultrasonics	5.5		637 638
	7.0		623 624 625 626 627 628 629 630 631 634 635 636
41666700 Death and dying behavioral development	1.5	610 616 618 620	
65620000 Mechanics of writing English	1.5	33 156 182	
	2.5	159 620	637 638
	3.5		623 624 625 626 627 628 629 630 631 634 635 636

Table 13. CURRICULUM OUTLINES FOR RADIATION THERAPY TECHNICIAN AND RADIATION THERAPY TECHNOLOGIST TASKS

p. 1 of 17

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
Object Manipulation Skills	1.5	576 585 586 587 588 589 590 591 593 596 597 598	575
	3.5	584 592 594 595 612	563 564 565 566 567 568 569 570 571 572 573 574 582 583 599 600 601 602 603 604 605 606 607 608 609 619 622
Guiding or Steering Skills	1.5	576	563 564 565 566 567 568 569 570 571 572 573 575 582 583 599 600 601 602 603 604 605 606 607 608 609 619 622
Human Interaction Skills	1.5	612 613 614 617	
	3.0	280 576 580 587	280 561 562 581 615
	5.0	595	574 575 582 583 619
	7.0		563 564 565 566 567 568 569 570 571 572 573 599 600 601 602 603 604 605 606 607 608 609 622

Note: Task descriptions appear in Research Report No. 9; abbreviated task names are listed in Table 1 and the tables in Appendix B. Full knowledge category names are in Table 9. HSMS scales are in Appendix C.

Table 13. RADIATION THERAPY (continued)

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
Oral Use of a Relevant Language	2.0	612 613 614	
	4.0	280 576 580 587 595 617	280 561 562 574 581 615
	7.5		563 564 565 566 567 568 569 570 571 572 573 575 582 583 599 600 601 602 603 604 605 606 607 608 609 619 622
Reading Use of a Relevant Language	2.0	580 584 585 586 587 588 589 590 591 592 594 596 597 598 612 613	574
	5.0	280 595	280 561 562 563 564 565 566 567 568 569 570 571 572 573 575 581 582 583 599 600 601 602 603 604 605 606 607 608 609 615 619 622

Table 13. RADIATION THERAPY (continued) p. 3 of 17

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
Written Use of a Relevant Language	2.0	580 585 586 587 588 589 590 591 592 593 594 595 596 597 598 613 614 617	563 564 565 566 567 568 569 570 571 572 573 575 581 582 583 599 600 601 602 603 604 605 606 607 608 609 615 619 622
	5.0		561
Decision Making on Methods	1.5	580 585 586 587 588 589 590 591 593 596 597 598 612 614 617	
	3.0	576 584 592 594 595 613	575 582 583 599 600 601 602 603 604 605 606 607 608 609 619 622
	4.5		561 562 563 564 565 566 567 568 569 570 571 572 573 574 581 615

Table 13. RADIATION THERAPY (continued) p. 4 of 17

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
Decision Making on Quality	2.0	590 593 594 598	
	3.5	280 580 584 585 586 587 588 589 596 597 612 613 614	280
	5.5	576 591 592	575 619
	7.0	595	561 562 563 564 565 566 567 568 569 570 571 572 573 574 581 582 583 599 600 601 602 603 604 605 606 607 608 609 615 622
Figural Skills	1.0	580 584 586 587 590 591 592 593 594 595 598	
	3.5	576 596 597	561 574 581 582 583 599 600 601 602 603 604 605 606 607 608 609 615 619 622
	5.0		562 563 564 565 566 567 568 569 570 571 572 573 575

Table 13. RADIATION THERAPY (continued) p. 5 of 17

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
Symbolic Skills	1.5	576 591 595 597 613 614 617	561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 581 583 599 600 601 602 603 604 605 606 607 608 609 619 622
Taxonomic Skills	2.0	576	561 562 563 564 565 566 567 568 569 570 571 572 573 575 581 582 583 599 600 601 602 603 604 605 606 607 608 609 615 619 622
Implicative Skills	1.0	576 595	574
	2.0	280	280 561 563 564 565 566 567 568 569 570 571 572 573 575 581 582 583 599 600 601 602 603 604 605 606 607 608 609 615 619 622
	4.0		562

Table 13. RADIATION THERAPY (continued) p. 6 of 17

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
Financial Consequences of Error	1.0	280 576 580 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 612 613 614 617	280 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 581 582 583 599 600 601 602 603 604 605 606 607 608 609 615 619 622
Consequences of Error to Humans	1.0	580 584 585 586 587 588 593 594 595 596 597 612 613 614 617	561 562 581 615
	2.0	589 590 591 592 598	574 582 583
	5.5	280	280
	7.0	576	563 564 565 566 567 568 569 570 571 572 573 575 599 600 601 602 603 604 605 606 607 608 609 619 622

Table 13. RADIATION THERAPY (continued) p. 7 of 17

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
11731000 Normal structure and function	1.5		615 619 622
	2.5		561 562 563 564 565 566 569 570 571 572 573 575 581 582 583 599 600 601 602 603 604 605 606 607 608
	3.5		567 568 609
11731100 Regional anatomy	1.5	580 586 595 597 598	
	2.5		574 601 605 606 615 619 622
	3.5	576	561 563 564 565 569 570 571 582 583 599 600 602 603 604 607 608 609
	5.5		562 566 567 568 572 573 575 581
11731200 Topographic anatomy	1.5	595	
	2.5	587	561 574 601 605 606 615 619 622
	3.5	576	561 565 569 570 571 582 583 599 600 602 603 604 607 608 609
	5.5		563 664 566 567 568 572 573 575 581

Table 13. RADIATION THERAPY (continued) p. 8 of 17

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
11731300 Hematopoietic system	2.5		573 609
11731400 Circulatory system	1.5		564 600
	2.5		566 602
11731500 Respiratory system	1.5		563
	2.5		564 600
11731600 Digestive system	1.5		603
	2.5		567 568
11731610 Mouth, pharynx, esophagus	1.5	587	563 599 600 622
	2.5		564
11731620 Stomach and small intestine	1.5		603
11731630 Large intestine (colon) and rectum	1.5		603 622
11731640 Liver, biliary system, and pancreas	1.5		603
11731700 Urinary system	1.5		603 604
	2.5		567 568 570 571 606 607
11731800 Musculoskeletal system	1.5		619
	2.5		563 564 565 566 567 568 569 570 571 572 573 581 582 583 599 500 601 602 603 604 605 606 607 608 609
	3.5		575
11731810 Muscles	1.5		565 599
	2.5		564 601 608

Table 13. RADIATION THERAPY (continued) p. 9 of 17

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
11731820 Bones and joints	2.5		563 566 567 568 569 570 571 572 573 575 599 600 601 602 603 604 605 606 607 608 609
11731831 Skin and sweat glands	1.5	587	565
	2.5		601
11731910 Central nervous system (brain and spinal cord)	2.5		563 599
11731943 Eye and optic nerve	1.5	594	563 583 599
11731945 The ear	1.5		563 599
11732210 Endocrine glands and hormone physiology	1.5		567 569 599
	2.5		571 603 605 607
11732222 Male reproductive system	1.5		604
	2.5		568 569 570 605 606
11732223 Female reproductive system	1.5		622
	2.5		567 603
11733200 Neoplasms (cancerous growths)	1.5		582 583
	2.5	580 587	574 575 619 622
	3.5		561 562 563 564 565 566 567 568 569 570 571 572 573 581 599 600 601 602 603 604 605 606 607 608 609 615

Table 13. RADIATION THERAPY (continued) p. 10 of 17

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
11733400 Disorders of blood, blood-forming organs	2.5		609
11733510 Disorders of central nervous system	1.5		563
	2.5		599
11733600 Disorders of the circulatory system	1.5		563 564 566
	2.5		600 602
11733700 Disorders of the digestive system	1.5		567
	2.5		603
11733800 Disorders of the respiratory system	1.5		564
	2.5		600
11733900 Disorders of the uro-genital system	1.5		567 568 569 570 571
	2.5		603 604 605 606 607
11734100 Disorders of skin, subcutaneous tissues	1.5		565 572
	2.5		601
11734200 Disorders of musculoskeletal system	1.5		572
	2.5		599 608
11734800 Shock and trauma	2.5		563 564 565 566 567 568 569 570 571 572 573 599 600 601 602 603 604 605 606 607 608 609

Table 13. RADIATION THERAPY (continued) p. 11 of 17

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
11735000 Surgery	1.5		561 562 563 564 565 566 567 568 569 570 571 572 573 581 599 600 601 602 603 604 605 606 607 608 609 615 619
11735100 Operative procedures	1.5		561 562 563 564 565 566 567 568 569 570 571 572 573 581 599 600 601 602 603 604 605 606 607 608 609 615 619
11735400 Introductory procedures	1.5		561 563 564 565 566 567 568 569 570 571 572 573 582 583 599 600 603 605 606 608 615 619
	2.5		581 604 607 622
11736000 Anesthesiology	1.5		581 583 599 600 602 603 604 605 606 607 608 609 615

Table 13. RADIATION THERAPY (continued) p. 12 of 17

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
11737000 First aid and care	3.5		563 564 565 566 567 568 569 570 571 572 573 599 600 601 602 603 604 605 606 607 608 609
1173710 Bandages, dressings, tourniquets, splints	1.5		561 563 564 565 566 567 568 569 570 571 572 573 581 582 583 599 600 601 602 603 604 605 606 607 608 609 615
11737200 Hemorrhage and bleeding and their arrest	1.5		563 564 565 566 567 568 569 570 571 572 573 599 600 601 602 603 604 605 606 607 608 609
11737300 Handling, transportation of the sick or wounded	3.5	576 580	561 562 581 615 619 622
	5.5	587 595	563 564 565 566 567 568 569 570 571 572 573 574 575 582 583 599 600 601 602 603 604 605 606 607 608 609

Table 13. RADIATION THERAPY (continued) p. 13 of 17

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
11737700 Wounds and their healing	1.5		581
11738000 Asepsis	2.5	594	563 564 565 566 567 568 569 570 571 572 573 581 583 599 600 601 602 603 604 605 606 607 608 609 615 619 622
11744000 Dentistry	1.5		599
11744200 Oral surgery	1.5	587	581
12210000 Radiobiology	1.5	585 586 588 589 593 613 614 617	
	2.5	280 584 587 590 591 592 594 595 596 597 598	280 582 583
	3.5	576	561 575 603 605 605 606 607 609 615 619 622
	5.5		562 563 564 565 566 567 568 569 570 571 572 573 581 599 600 601 602 608

Table 13. RADIATION THERAPY (continued) p. 14 of 17

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
12221000 Radiotherapy	1.5	588 589 593 597	
	2.5	580 584 585 586 587 590 591 592 594 595 596 598 612 613 614 617	575 619
	3.5	576	574 581 582 583 599 600 601 602 603 604 605 606 607 608 609 615 622
	5.5		561 563 564 565 566 567 568 569 570 571 572 573
	7.0		562
12222000 Radionuclide therapy	1.5		562 563 564 565 566 567 568 569 570 571 572 573 581 599 600 601 602 603 604 605 606 607 608 609 615
	2.5		561

Table 13. RADIATION THERAPY (continued) p. 15 of 17

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
12223000 Diagnostic radiography	1.5	597	
	2.5		561 574 581 599 600 601 602 603 604 605 606 607 608 609 615 619
	3.5	576	562 563 564 565 566 567 568 569 570 571 572 573 622
	5.5		575
12300000 Pharmacology	1.5		561 562 563 564 565 566 567 568 569 570 571 572 573 599 600 601 602 603 604 605 606 607 608 609
12332000 Drug idiosyncrasy, allergy pharmacogenetics	1.5		571
12341100 Antibacterial and antifungal chemotherapy	1.5		622
12341300 Cancer and virus chemotherapy	1.5		561 562 563 564 565 566 567 568 569 570 571 572 573 581 599 600 601 602 603 604 605 606 607 608 609 615
13322000 Properties of lead	1.5		562 581
13323000 Properties of the alkali metals	1.5		562
13332000 Properties of iron, cobalt, nickel	1.5		562

Table 13. RADIATION THERAPY (continued) p. 16 of 17

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
14111000 Solutions	1.5		581
15222500 Interaction with radiation	1.5	280 584 586 587 590 591 592 594 595 596 597 598	280 575 619
	2.5		561 563 564 565 566 567 568 569 570 571 572 573 581 599 600 601 602 603 604 605 606 607 608 609 615 622
	3.5		562
25500000 Casting	1.5	584 585 586 587 588 589 592 593 594 598	583
	2.5		581
25600000 Tools and dies	1.5	592 594	581
25700000 Fabrication selection	1.5		581
36220000 Processed metals	1.5	589 591 592 594 596 598	581
36800000 Stone, marble and gems	1.5	585	581
37100000 Concrete, gypsum and plaster	1.5	584 585 586 588 589	581
37700000 Plastics	1.5	584 586 590 594	
	2.5		581

Table 13. RADIATION THERAPY (continued) p. 17 of 17

Abbreviated Name of Skill or Knowledge Category	Scale Value	Level 2 Technician Tasks	Level 3 Technologist Tasks
41666700 Death and dying behavioral development	1.5	587 595	561 563 564 565 566 567 568 569 570 571 572 573 574 575 583 599 600 601 602 603 604 605 606 607 608 609 619 622
51200000 Algebra	1.5	613	562
65620000 Mechanics of writing English	1.5	580 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 613 614 617	574 583
	2.5		561 563 564 565 566 567 568 569 570 571 572 573 575 581 599 600 601 602 603 604 605 606 607 608 609 615 619 622

APPENDIX E

EXAMPLES OF HSMS CURRICULUM OBJECTIVES

Skill Objectives. E-1

Selected Knowledge Category Objectives. E-16

The task descriptions whose language is reflected in the objectives presented and to which the curriculum objectives refer by Task Code or by name are in Volumes 2 and 3 of Research Report No. 7. The curriculum objectives are taken from Research Report No. 8, Volume 2.

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Type of Objective Skill Factor ______ No. 10

Skill or Knowledge Category Object Manipulation Skills Scale Value 3.5

Occupation Radiologic Technologist Level 3

Refers to Task Code No(s).: 365 375 376 377 380 388 390 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 513 514 516 518 519 526

Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to achieve the degree of control and precision in the manipulation of objects with the fingers, hands, or limbs with the fineness of motion appropriate to achieving the standards set for manipulation of objects in the following activities:

1. Placing, positioning infant or pediatric patient's fingers, hands or arms for radiography and using immobilization devices (Tasks 376, 493, 510).
2. Placing, positioning infant or pediatric patient's toes, feet or legs for radiography and using immobilization devices (Tasks 376, 377, 496, 510).
3. Placing, positioning infant, pediatric or adult patient's torso and neck, and using immobilization devices to obtain exact angulation and centering and/or maintain sterile field (Tasks 376, 380, 388, 390, 492, 494, 495, 498, 499, 500, 501, 502, 503, 506, 507, 508, 509, 510, 511, 512, 513, 514, 516, 518, 519, 526).
4. Placing, positioning infant, pediatric or adult patient's head, and using immobilization devices to obtain exact angulation and centering (Tasks 365, 375, 380, 491, 497, 504, 505, 506, 526).

To accomplish this, the student must be able to state what standards of precision must be achieved for each activity, and must be able to exercise the degree of control and precision necessary to achieve the standards.

Cross Reference Footnotes: See The Following Curriculum Objectives:

Lower scale value appears in: 1 2 3 4 5.

Same scale value appears in: 6 7 8 9 and levels 4 and 5.

Higher scale value appears in: 11 12 13.

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Type of Objective Skill **Factor** ________ **No.** 17
Skill or Knowledge Category Guiding or Steering Skills **Scale Value** 1.5
Occupation Radiologic Technologist **Level** 3
Refers to Task Code No(s).: 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 463 465 466 467 468 491 492 493 494 495 496 499 500 (*continued below)
Is there Cross Reference? ...Yes( ) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to coordinate his or her perception of external stimuli which inform him or her of his or her position in order to control an object being moved over a predetermined pathway in the following activities so as to achieve the degree of precision necessary to accomplish the objective within an acceptable margin of error:

1. Wheeling patient on stretcher or in wheelchair and positioning next to radiographic examination table (all tasks listed above except Tasks 369, 370, 371, 372, 373 and 463).

2. Transporting mobile x-ray equipment from department to bedside or operating room positions,and/or wheeling PEG chair or serial cassette changer into position for radiographic examination (Tasks 369, 370, 372,373, 463, 504, 505, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519).

To accomplish this, the student must be able to state what external stimuli must be attended to, what coordination is required, and what margin of error is allowable in the movement of the object to achieve the standards.

Cross Reference Footnotes: See The Following Curriculum Objectives:
Same scale value appears in: 14 15 16.
Higher scale value appears in: 18 19.

* 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 526.

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Type of Objective Skill Factor ______ No. 30
Skill or Knowledge Category Human Interaction Skills Scale Value 3.0
Occupation Radiologic Technologist Level 3
Refers to Task Code No(s).: 81 280 353 369 370 371

Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to exercise sensitivity to others, and be sufficiently perceptive of the relevant characteristics or state of being of other people in the following activities to be able to pay attention to feedback in interaction, and adjust his or her behavior as appropriate to accomplish the purpose of the tasks in which the interactions occur. These activities include:

1. In reviewing the technical quality of "plain film" radiographs taken by co-worker, discussing whereabouts of missing views, suggesting alternative positioning, asking opinions of supervisor or radiologist about diagnostic quality and need for "retakes," suggesting additional views to obtain more complete information (Task 81).

2. Discussing possible causes for unusually high radiation exposure reading of performer's own radiation detection dosimeter and possible transfer to other work (Task 280).

3. Asking questions, raising issues, participating in discussions at meeting of diagnostic x-ray department technologists (Task 353).

4. Greeting patient to have radiographic examination; explaining what will be involved in the procedure; indicating what cooperation will be asked of patient; answering patient's non-medical questions honestly; attempting to reassure patient and develop confidence; treating patient with dignity and concern regardless of patient's behavior (in tasks with limited patient contact) (Tasks 369, 370, 371).

To accomplish this, the student must be able to demonstrate sufficient awareness of what the relevant characteristics are of the "other" in the given situation, must be able to demonstrate sufficient perception of the feedback from the "other," and must be able to indicate what the proper adjustment must be in his or her behavior to accomplish the activities which engendered the interaction, and do this at the quality standard set.

Cross Reference Footnotes: See The Following Curriculum Objectives:
Lower scale value appears in: 20 21 22 23 24 25.
Same scale value appears in: 26 27 28 29 31.
Higher scale value appears in: 32 33 34 35 36.

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Type of Objective Skill Factor ______ No. 41
Skill or Knowledge Category Leadership Skills Scale Value 4.5
Occupation Administrative Technologist Level 3
Refers to Task Code No(s).: 131

Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to indicate the extent to which he or she is called on to provide leadership to subordinates (in line relation or de facto) so as to influence their work behavior, in order to accomplish work objectives such as the following:

1. Obtaining staff preferences on work, vacation, days off, lunch and break time preferences; assigning and informing staff of scheduled assignments; making reassignments as needed (Task 131).

To accomplish this, the student must be able to state what power he or she has over the subordinates' conditions of employment (hiring, firing, promotions, raises, transfers, overtime, special privileges) in this situation; indicate how less leadership is needed the greater the power; and state what can be done to reduce or increase the need for leadership.

The student must be able to state what channels of communication exist for giving orders in this situation, for receiving or giving information, for the evaluation of and for exercising discipline over the subordinates; indicate how less leadership is needed the more precisely known and formalized these channels are; and state what can be done to reduce or increase the need for leadership.

The student must be able to state the degree to which the tasks of subordinates which are to be accomplished are clearly defined and understood by the subordinates in this situation; indicate how less leadership is needed the clearer the subordinates' own tasks are to them; and state what can be done to reduce or increase the need for leadership.

Cross Reference Footnotes: See The Following Curriculum Objectives:
Lower scale value appears in: 37 38 39.
Same scale value appears in: 40 and level 4.

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Type of Objective Skill Factor ________ No. 48
Skill or Knowledge Category Oral Use of a Relevant Language Scale Value 4.0
Occupation Patient Care Technician Level 2
Refers to Task Code No(s).: 18 33 65 133 143 156 181 182 185 198 243 280 296 298 299 522

Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to communicate orally (in an appropriate language) and comprehend what is said in that language with a sufficient degree of precision to accomplish the following activities by expressing or comprehending meaning with the degree of precision needed:

1. Explaining to patient what will be done in drawing blood (Task 18), removing sutures (Task 33), using suction machine (Task 182), administering oxygen (Task 185), applying pressure dressing (Task 522).

2. Discussing timing of specimen-taking procedures with physician so that performer may receive body fluid, washings, and/or cell or tissue biopsies and prepare them for transportation to laboratory (Task 65).

3. Explaining name and purpose of medication and possible side effects; asking about patient's allergies; reporting contraindications to physician (Tasks 133, 198, 298, 299).

4. Explaining catheterization procedure to patient; reporting to physician reason for terminating if there is severe pain or blockage (Tasks 143, 181).

5. Telling physician if patient's wound or opening appears suspicious or if performer is unsure how to irrigate, medicate or dress (Task 156).

6. Explaining to staff member need for restraining patient, and asking why this was not done beforehand (Task 243).

7. Discussing possible reasons for unusually high radiation exposure reading on performer's radiation detection device; discussing possible transfer of work (Task 280).

8. Determining from co-workers information about a patient and the situation involved in a possible emergency; when physician arrives, reporting what has happened and what emergency care has been administered (Task 296).

To accomplish this, the student must be able to deal with the nuances of oral language with sufficent precision to use the words needed correctly in context, or grasp the meaning (or question a speaker about intended meaning), so that the activities involved can be accomplished satisfactorily.

Cross Reference Footnotes: See the Following Curriculum Objectives:
Lower scale value appears in: 42 43 44 45 46.
Same scale value appears in: 47 49 50 51 52 and level 4 of patient care.
Higher scale value appears in 53.

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Type of Objective Skill Factor ______ No. 63
Skill or Knowledge Category Reading Use of a Relevant Language Scale Value 5.0
Occupation Radiologic Technologist Level 3
Refers to Task Code No(s).: 81 280 355 356 357 358 359 360 361 362 363 364 365 366
367 368 369 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390
463 464 465 466 467 468 491 492 493 494 495 496 497 498 499 500 (*continued below)
Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to read and comprehend the meaning of any printed or written material (in an appropriate language) with a sufficient degree of precision to accomplish the following activities, based on the preciseness of comprehension of the materials read:

1. Reading requisition sheet and patient's relevant medical-technical history to determine the examination called for, the part of the body, the views ordered, the purpose, the patient involved, any special considerations; reading to check on possible contraindications, radiation exposure history, any prior preparation, special requests, medications or anesthesia ordered; reading to learn patient's condition, means of arrival, whether accompanied, any special equipment or contrast media ordered, and any other information about how the procedure is to be carried out (all tasks listed except Task 280).

2. Reading letter informing performer of unusually high monthly radiation exposure or of high cumulative exposure and/or requesting presence at an interview (Task 280).

Cross Reference Footnotes: See The Following Curriculum Objectives:
Lower scale value appears in: 54 55 56 57 58 59.
Same scale value appears in: 60 61 62 and level 4.
Higher scale value appears in level 5.

* 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 526.

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Type of Objective Skill Factor ______ No. 68
Skill or Knowledge Category Written Use of a Relevant Language Scale Value 2.0
Occupation Radiologic Technologist Level 3
Refers to Task Code No(s).: 81 353 355 356 357 358 359 360 361 362 363 364 365 366 367 368 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 463 464 465 466 467 468 491 492 493 494 495 496 (*continued below)
Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to convey meaning by writing or dictating (in an appropriate language) with a sufficient degree of precision in the words, sentences, and/or paragraphs formed to accomplish the following activities, based on the clarity of meaning conveyed in the materials written or dictated:

1. Recording order for "retakes" of radiographs or suggestions for additional views in connection with quality review of "plain film" radiographs (Task 81).

2. Making notes in preparation for or during a departmental meeting (Task 353).

3. Recording radiographic examination; including date, room, examination type, the views taken including any serial films, the technical factors used, film size, the number of exposures made of each view including retakes; recording fluoroscopic and cine exposure time; recording the estimated radiation dose to which patient was exposed (if posted information on dosage is available); recording any problem with equipment, any special care provided patient; recording reasons any views called for in the initial request could not be obtained (all tasks listed except Tasks 81, 353 as appropriate).

Cross Reference Footnotes: See The Following Curriculum Objectives:
Same scale value appears in: 64 65 66 67 69 and level 4.
Higher scale value appears in: 70.

* 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 526.

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Type of Objective Skill **Factor** ________ **No.** 81
Skill or Knowledge Category Decision Making on Methods **Scale Value** 3.0
Occupation Radiologic Technologist **Level** 3
Refers to Task Code No(s).: 81 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 463 464 465 466 467 468 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 526
Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to carry out the responsibility of exercising a choice over how to carry out the following task activities by choosing the appropriate option regarding what to do, what to use, or how to do the activities as appropriate to the instances of the tasks as they present themselves, and within the guidelines provided for making the choice. The tasks or activities in which this skill must be exercised are as follows:

1. Deciding whether to recommend "retakes" of radiographs or additional views based on requisition sheet orders while providing technical quality review of "plain film" radiographs; deciding whether to ask opinion of radiologist about adequacy for diagnostic purposes; deciding whether to assist technologist or explain what is needed; deciding whether to report to supervisor (Task 81).

2. Deciding whether to bring to attention of radiologist missing or inadequate information or possible contraindications, or to ask about information to help in positioning or care of patient; deciding whether to personally prepare any materials or supplies; deciding whether to arrange for isolation or decontamination procedures, whether to assist in transporting patient from holding area and/or to or from examination table or have co-worker assist; selecting appropriate steps to accommodate patient's condition and mobility--in tasks involving tomography and/or contrast media where radiologist is in charge (all tasks listed except Task 81).

To accomplish appropriate decision making on methods the student must be able to indicate the variety of situations likely to occur which would require making the choices, must be able to specify the choices available, and must be able to state what appropriate guidelines there are in order to accomplish the tasks successfully. The student should be able to list the choices, their indications for use and their contraindications, and must be able to provide justifications for the choices.

Cross Reference Footnotes: See The Following Curriculum Objectives:
Lower scale value appears in: 71 72 73 74 75 76.
Same scale value appears in: 77 78 79 80 82.
Higher scale value appears in: 83 84 85 86.

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Type of Objective Skill Factor ________ No. 94

Skill or Knowledge Category Decision Making on Quality Scale Value 3.5

Occupation Patient Care Technician Level 2

Refers to Task Code No(s).: 18 33 65 280 298 522

Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to carry out the responsibility of exercising control over the quality of his or her task performance in the area of latitude provided between minimum standards and the highest possible quality that can be achieved. Activities in which this skill must be exercised are as follows:

1. In drawing blood from a non-pediatric patient's vein, being careful to select the appropriate vein, puncture properly, or ask for help if performer has difficulty in finding the vein (Task 18).
2. In removing a patient's sutures, taking care to examine the sutured area and note the condition and healing; deciding to irrigate or have antibiotics prescribed when appropriate (Task 33).
3. In preparing specimens for the laboratory, taking care in handling when picking out tissue fragments or dealing with bronchial washings (Task 65).
4. In participating in monitoring of personal exposure to radiation, being alert to possible accidental or excessive personal exposure; notifying designated staff member (Task 280).
5. In administering medication orally to any patient without prior check by physician, taking care to measure carefully and check for any signs of deterioration prior to administering (Task 298).
6. In applying a pressure dressing to a puncture site, taking care to note whether wound shows appearance of problem such as lack of pulse, hematoma, swelling; reporting this at once (Task 522).

To accomplish appropriate decision making on quality the student must be able to indicate the minimum standards for acceptable performance of the tasks or for the outputs of the tasks, must be able to indicate what latitude above the minimum standards is available to the performer to improve the quality, and must be able to indicate what priorities should be used to exercise judgment on when and where to exceed minimum standards of quality.

Cross Reference Footnotes: See The Following Curriculum Objectives:

Lower scale value appears in: 87 88 89 90 91 92.

Same scale value appears in: 93 95 96 97 98.

Higher scale value appears in: 99 100 101 102 103 104 105.

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Type of Objective Skill Factor ________ No. 112

Skill or Knowledge Category Figural Skills Scale Value 5.0

Occupation Radiologic Technologist Level 3

Refers to Task Code No(s).: 81 374

Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to mentally manipulate (with or without physically manipulating) the figural aspects of objects in terms of size, shape, form, density, arrangement in space, in static array or in motion, to achieve the predetermined figural standards or objectives of size, shape, form, density, or arrangement in the following activities:

1. In evaluating "plain film" radiographs, assessing whether the correct patient view and full area of interest is demonstrated, whether a needlessly large area is visible, whether appropriate shielding is evident; evaluating image to note artifacts, blurring, or distortion, judge whether there is adequate detail and definition, and adequate density and contrast to provide the diagnostic imaging required for the examination (Task 81).

2. In positioning patient for tomography, considering the travel of the central ray and selecting position to minimize exposure of sensitive portions of the body not being examined, or deciding on shielding (Task 374).

3. Localizing the level of a lesion for tomography by working with frontal and lateral projections; locating marked center of area using visible reference points; reproducing markings made on radiographs on patient's body; locating area of lesion on lateral view so that distance to table above and below lesion can be estimated; determining level of initial "cut" (Task 374).

To accomplish this, the student must be able to state what figural standards must be achieved for each activity, and must be able to exercise the degree of figural mental precision necessary to achieve the standards.

Cross Reference Footnotes: See The Following Curriculum Objectives:

Lower scale value appears in: 106 107 108 109 110 111.

Same scale value appears in levels 4 and 5.

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Type of Objective Skill Factor ____ No. 115
Skill or Knowledge Category Symbolic Skills Scale Value 1.5
Occupation Radiologic Technologist Level 3
Refers to Task Code No(s).: 335 356 357 358 359 360 361 362 363 364 365 366 367 368 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 463 464 465 466 467 468 491 492 493 494 495 496 497 498 (*continued below)
Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to mentally manipulate and/or use symbols which are part of an abstract, non-representational system of notation where the symbols stand for properties, relationships, or operations in the following activities:

1. Using formula for magnification to solve equations for unknown portions (distances); using arithmetic manipulations and numerical and algebraic symbols (tasks where appropriate).
2. Using conversion charts or posted information to reconvert technical exposure factors to an equivalent output using arithmetic manipulations and numerical symbols (tasks where appropriate).
3. Calculating distances in order to localize lesion using arithmetic manipulations and numerical symbols (Task 374).

To accomplish this, the student must be able to indicate what each symbol represents, must be able to manipulate each as required, and be sufficiently accurate to meet the standards for the activities.

Cross Reference Footnotes: See The Following Curriculum Objectives:
Same scale value appears in: 113 114.
Higher scale value appears in level 5.

* 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519.

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Type of Objective Skill Factor ________ No. 118

Skill or Knowledge Category Taxonomic Skills Scale Value 2.0

Occupation Radiologic Technologist Level 3

Refers to Task Code No(s).: 81 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 463 464 465 466 467 468 491 492 493 494 495 496 (*continued below)

Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to consciously apply conceptual classifying or organizing principles to suit the needs of the following activities:

1. In considering the quality of radiographs, noting appearances that seem medically suspicious, signs of pathological conditions (Task 81).

2. Considering what technologist should do to improve quality of radiographs, such as adjustment of technical factors, repositioning of patient, or making additional exposures (Task 81).

3. Determining from requisition sheet, patient's medical-technical chart, and/or staff the examination called for, the patient involved, special considerations, patient's condition; checking for possible contraindications; noting information that may affect how patient is to be handled or technical factors; noting or selecting equipment to be used; checking on completeness of information; determining what prior preparation was ordered; selecting appropriate steps (all tasks listed except Task 81).

4. Evaluating orders for patient positions and projections of the area of interest in relation to patient's condition; considering the need for a change from standard positions to accomplish the purpose of the examination and offer the least discomfort to patient (all tasks listed).

5. Considering patient's body type, size, sex, age or muscularity in determining correct technical factors and positioning (tasks listed as appropriate).

6. Observing patient throughout procedure and being alert for any signs of pain, emergency, adverse reaction to procedure or contrast medium, or impairment of respiration; noting any signs of malfunction of equipment (all tasks listed except Task 81).

To accomplish this, the student must be able to indicate what existing principles of classification or organization are appropriate to the situations of the tasks, and must indicate how they must be applied to suit the needs of the situations acceptably.

Cross Reference Footnotes: See The Following Curriculum Objectives:

Same scale value appears in: 116 117.

Higher scale value appears in level 5.

* 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 526.

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Type of Objective Skill Factor ____ No. 126

Skill or Knowledge Category Implicative Skills Scale Value 2.0

Occupation Quality Assurance Technician Level 2

Refers to Task Code No(s).: 78 276 280 524 525 550

Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to come to conclusions, draw implications, or foresee consequences based on information in order to carry out the following activities:

1. In checking and jacketing radiographic materials and finding missing information, concluding what a radiograph represents, the view, the patient,or the technologist who made it,based on information sources and other materials available (Task 78).
2. Concluding the probable source of reported problems with automatic x-ray film processing machine, the method of investigation, and what to do (Task 276).
3. Concluding whether performer has been accidentally exposed to excessive radiation, and/or drawing implications about past exposure to try to explain source of recorded high personal exposure to radiation (Task 280).
4. Concluding the possible source of problems with computerized transverse axial tomography equipment and the method of investigation or repair (Tasks 524, 525).
5. Concluding whether stray radiation and transmission across primary and secondary protective barriers in a diagnostic x-ray installation survey is within acceptable limits for personnel maximum permissible dose equivalents after making appropriate tests and considering appropriate factors; drawing implications for deployment of staff, on sources of problems, on corrective measures, effect of problems and deviations from acceptable standards (Task 550).

To accomplish this, the student must be able to indicate the types of information from which he or she must draw in the various instances of the activity which may arise, and must be able to indicate what inferences, consequences, or conclusions are implied by various possible combinations of information as appropriate for the situations. The student should be able to defend the implications drawn using appropriate criteria.

Cross Reference Footnotes: See The Following Curriculum Objectives:
Lower scale value appears in: 119 120 121 122 123.
Same scale value appears in: 124 125 127.
Higher scale value appears in: 128 and level 5.

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Type of Objective Skill Factor ____ No. 136
Skill or Knowledge Category Financial Consequences of Error Scale Value 4.0
Occupation Quality Assurance Technician Level 2
Refers to Task Code No(s).: 175 178 276 535

Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to display an appropriate awareness of the financial consequences which can result from errors, even after proper training, in the performance of the following tasks:

1. Performing penetrometer calibration test of kVp or mA selectors of x-ray machine output (Task 175).

2. Checking, preparing fluoroscope controls (and phototimer) (Task 178).

3. Making minor adjustments or repair on automatic x-ray film processor (Task 276).

4. Performing calibration tests of kVp, mA, mAs, exposure rates, reproducibility on diagnostic radiography equipment using direct measuring instruments and/or radiographic comparisons (Task 535).

To accomplish this, the student must be able to indicate the financial value of the output, equipment, materials, or time involved in the tasks. The student should be able to indicate what the most obvious errors during learning would be, the most serious likely error after proper training has been accomplished, what the financial consequences would be, should be able to state what should be done to avoid the errors, and should be able to carry this out.

Cross Reference Footnotes: See The Following Curriculum Objectives:
Lower scale value appears in: 129 130 131 132 133 134.
Same scale value appears in: 135 137 and level 5.

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Type of Objective Skill Factor ______ No. 154

Skill or Knowledge Category Consequences of Error to Humans Scale Value 5.5

Occupation Patient Care Technician Level 2

Refers to Task Code No(s).: 65 280 296 298 299 522

Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to display an appropriate awareness of what harm can be done to self, patients, co-workers, or society as a whole, as a result of errors, even after proper training, in the performance of the following tasks:

1. Preparing specimens such as extravascular body fluids, washings, cell and/or tissue biopsies for transportation to laboratory (Task 65).
2. Participating in monitoring of personal exposure to radiation by periodically turning in and replacing film strip in badge worn by performer (Task 280).
3. Providing first aid in x-ray department emergency (Task 296).
4. Administering medication orally to any patient according to MD's orders (Task 298).
5. Administering subcutaneous or intramuscular injection for any patient according to MD's orders (Task 299).
6. Applying pressure dressing to arterial or venous puncture site (Task 522).

To accomplish this, the student must be able to indicate the harm that can be done to humans at every point in the steps of the task(s). The student should be able to indicate what the most obvious errors during learning would be, the most serious likely error after proper training has been accomplished, what the consequences for humans would be, should be able to state what should be done to avoid error(s), and should be able to carry this out.

Cross Reference Footnotes: See The Following Curriculum Objectives:
Lower scale value appears in: 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152.
Same scale value appears in: 153 154 155 156 157.
Higher scale value appears in: 158 159 160 161.

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Type of Objective Knowledge Factor ________ No. 162

Skill or Knowledge Category 11731000 Scale Value 2.5

Occupation Radiologic Technologist Level 3

Refers to Task Code No(s).: 353 362 363 368 371 376 378 381 382 383 384 385 386 387 388 389 390 463 465 496 500 501 502 503 511 512 513 515 518 519

Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to demonstrate mastery of the following subject area

Normal Structure and Function (human anatomy and physiology; an overview of the nature of normal structure, function, and/or interrelationships of systems and processes)

at a level of awareness and depth of understanding adequate to the proper performance of the following activities:

1. In participating in meeting of diagnostic x-ray department technologists, being able to comprehend, raise issues, or participate in any discussion requiring an overview of normal human anatomy and physiology as it relates to radiographic examinations, use of equipment,or patient care (Task 353).
2. Applying information about normal structure and function to take account of patient's size, sex, body type, muscularity or other tissue characteristics in relation to centering, positioning of patient, selection of film size, and selection of technical factors for radiographic examination requested (all tasks listed except 353).

To accomplish these activities the student must have a detailed knowledge of the subject category, covering the appropriate technical or special terms, facts, equipment, and/or procedures which are part of this discipline and are required for successful completion of the activities listed above.

Cross Reference Footnote:
Higher scale value appears in level 4.

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Type of Objective Knowledge Factor ________ No. 163

Skill or Knowledge Category 11731100 Scale Value 2.5

Occupation Radiologic Technologist Level 3

Refers to Task Code No(s).: 372 464

Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to demonstrate mastery of the following subject area

Regional Anatomy (includes head and neck, thorax and abdomen, pelvis and perineum, lower and upper limbs, and skeleton; internal structure and connections between major parts, systems, and sections of the body)

at a level of awareness and depth of understanding adequate to the proper performance of the following activities:

1. In taking intravisceral or isolated operating room radiographs, considering the area of the body indicated on requisition in terms of patient's size, sex, body type, muscularity in order to select technical factors and film size (Task 372).
2. In assisting with fluoroscopy and spot filming, considering the part of the body involved in order to prepare equipment and preselect fluoroscopic and spot film technique (Task 464).

To accomplish these activities the student must have a detailed knowledge of the subject category, covering the appropriate technical or special terms, facts, equipment, and/or procedures which are part of this discipline and are required for successful completion of the activities listed above.

Cross Reference Footnotes: See The Following Curriculum Objectives:
Higher scale value appears in: 164 165 166 167 168.

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Type of Objective Knowledge Factor ______ No. 165
Skill or Knowledge Category 11731100 Scale Value 3.5
Occupation Radiologic Technologist Level 3
Refers to Task Code No(s).: 355 356 357 358 359 360 361 362 363 364 365 366 367 368 370 371 373 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 463 465 466 467 468 491 492 493 494 495 496 497 498 499 500 (*continued below)
Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to demonstrate mastery of the following subject area

> Regional Anatomy (includes head and neck, thorax and abdomen, pelvis and perineum, lower and upper limbs, and skeleton; internal structure and connections between major parts, systems, and sections of the body).

at a level of awareness and depth of understanding adequate to the proper performance of the following activities:

1. After reading requisition sheet indicating area of interest, being able to select appropriate film size, patient positions and centering to demonstrate the part of the body involved; being able to consider internal structures in relation to patient positions, taking account of patient's age, sex, size and body type as appropriate for the area of interest (all tasks listed).

2. Considering appropriate shielding for radiosensitive tissue by considering the direction of the central ray and the proximity of tissues in the area of interest to radiosensitive tissues (all tasks listed).

3. Positioning patient in relation to film and x-ray beam to obtain views requested; selecting technical factors appropriate to the area of interest and tissue type involved (all tasks listed).

To accomplish these activities the student must have a detailed knowledge of the subject category, covering the appropriate technical or special terms, facts, equipment, and/or procedures which are part of this discipline and are required for successful completion of the activities listed above.

Cross Reference Footnotes: See The Following Curriculum Objectives:
Lower scale value appears in: 163
Same scale value appears in: 164.
Higher scale value appears in: 166 167 168.

* 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519.

CURRICULUM OBJECTIVE SHEET

Type of Objective Knowledge Factor ________ No. 174
Skill or Knowledge Category 11731200 Scale Value 3.5
Occupation Radiologic Technologist Level 3
Refers to Task Code No(s).: 355 356 357 358 359 360 361 362 363 364 365 366 367 368 370 371 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 463 465 466 467 468 491 492 493 494 495 496 497 498 499 500 (*continued below)
Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to demonstrate mastery of the following subject area

Topographic Anatomy (relation of external physical manifestations to internal structure and function of parts of the body)

at a level of awareness and depth of understanding adequate to the proper performance of the following activities:

1. In positioning patient, being able to select the appropriate external anatomical reference points to position patient for the specific examination according to the area of the body involved, or to select alternative points if patient is obese and traditional points are obscured by fat; being able to account for bodily habitus in relating external references to internal structures; being able to refer to, draw,or imagine anatomical reference lines to provide appropriate angulation and rotation; being able to locate position of gonads to provide appropriate shielding based on position of patient (all tasks as appropriate).

2. In positioning patient, being able to take account of location of suspected fractures, unhealed fractures,or presence of foreign bodies and handle patient accordingly (all tasks as appropriate).

To accomplish these activities the student must have a detailed knowledge of the subject category, covering the appropriate technical or special terms, facts, equipment, and/or procedures which are part of this discipline and are required for successful completion of the activities listed above.

Cross Reference Footnotes: See The Following Curriculum Objectives:
Lower scale value appears in: 169 170 171 172.
Same scale value appears in: 173.
Higher scale value appears in: 175 176.

* 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519.

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Type of Objective Knowledge Factor ______ No. 201
Skill or Knowledge Category 11732223 Scale Value 1.5
Occupation Radiologic Technologist Level 3
Refers to Task Code No(s).: 374 465 466 467 468 503 512 526

Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to demonstrate mastery of the following subject area

Female Reproductive System (includes the body changes associated with ovulation, conception and pregnancy, e.g., development of placenta)

at a level of awareness and depth of understanding adequate to the proper performance of the following activities:

1. In taking tomograms, pelvic pneumograms/hysterosalpingograms, fetograms, amniograms, placentograms, uterograms, radiographs for pelvimetry, genitograms for intersex condition, pelvic angiograms, being able to use details of the structure and function of the female reproductive system and related organs in order to position patient, provide centering and collimation, direct central ray, and select technical factors (all tasks listed).

To accomplish these activities the student must have a detailed knowledge of the subject category, covering the appropriate technical or special terms, facts, equipment, and/or procedures which are part of this discipline and are required for successful completion of the activities listed above.

Cross Reference Footnote:
Higher scale value appears in level 4.

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Type of Objective Knowledge **Factor** ____ **No.** 202
Skill or Knowledge Category 11733200 **Scale Value** 1.5
Occupation Radiologic Technologist **Level** 3
Refers to Task Code No(s).: 353 362 363 364 366 368 374 375 376 378 379 380 381 382 383 384 385 386 387 388 389 390 463 465 494 495 498 499 500 501 502 504 505 506 508 509 511 512 514 515 516 518 526
Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to demonstrate mastery of the following subject area

Neoplasms (cancerous growths)

at a level of awareness and depth of understanding adequate to the proper performance of the following activities:

1. In participating in meeting of diagnostic x-ray department technologists, being able to comprehend, raise issues, or participate in any discussion dealing with neoplasmic diseases as they affect patient care and radiographic examinations (Task 353).

2. In taking radiographs, being able to use details about the way neoplasms manifest in the area of interest listed on the requisition sheet so as to properly handle patient, position patient properly, apply immobilization devices safely, and select technical factors (all tasks except Task 353).

To accomplish these activities the student must have a detailed knowledge of the subject category, covering the appropriate technical or special terms, facts, equipment, and/or procedures which are part of this discipline and are required for successful completion of the activities listed above.

Cross Reference Footnote:
Higher scale value appears in level 4.

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Type of Objective Knowledge Factor ________ No. 254

Skill or Knowledge Category 11737300 Scale Value 5.5

Occupation Radiologic Technologist Level 3

Refers to Task Code No(s).: 353 355 356 357 358 359 360 361 362 363 364 365 366 367 368 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 463 465 466 467 468 491 492 493 494 495 496 497 498 499 500 (*continued below)

Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to demonstrate mastery of the following subject area

Handling and Transportation of the Sick or Wounded.

at a level of awareness and depth of understanding adequate to the proper performance of the following activities:

1. In participating in meeting of diagnostic x-ray department technologists, being able to comprehend, raise issues, or participate in any discussion dealing with the handling and transportation of sick or wounded patients during radiographic examinations (Task 353).

2. In taking radiographs, being able to use details about the proper way to handle and transport sick or wounded patients so as to properly assist or transfer patient to or from wheelchair, stretcher, examination table, lavatory, determine when to request assistance in moving patient, and to position and immobilize patient so as to avoid injury or unnecessary pain, based on the patient's age and condition (all tasks listed except Task 353).

To accomplish these activities the student must have a detailed knowledge of the subject category, covering the appropriate technical or special terms, facts, equipment, and/or procedures which are part of this discipline and are required for successful completion of the activities listed above.

Cross Reference Footnotes: See The Following Curriculum Objectives:
Lower scale value appears in: 246 247 248 249 250 251 252.
Same scale value appears in: 253 and level 4.

* 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 526.

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Type of Objective Knowledge Factor ____ No. 291
Skill or Knowledge Category 12223000 Scale Value 3.5
Occupation Radiologic Technologist Level 3
Refers to Task Code No(s).: 372 373 464

Is there Cross Reference? ...Yes(X) ...No( ) If yes, see footnote(s).

Content: A graduate of the program at this educational level must be able to demonstrate mastery of the following subject area

Diagnostic Radiography (application of electromagnetic ionizing radiation such as x-rays to achieve interpretable images for diagnostic purposes; also includes fluoroscopy, use of related techniques, contrast media, procedures, positioning, interpretation of images)

at a level of awareness and depth of understanding adequate to the proper performance of the following activities:

1. Using an understanding of diagnostic radiography and appropriate details about diagnostic x-ray equipment, technical factors, controls, collimators, light systems, focal-film and focal-patient distances, tube angulation, centering, and patient positioning to achieve desired views in taking intravisceral or isolated operating room radiographs or operating room radiographs for opaque foreign body search;

   being able to select and prepare film for use in holder, prepare and use identification and right-left markers, set up mobile equipment, position and angle x-ray tube, adjust focal film distance, adjust collimation to area of interest, select and set technical factors, make exposure, monitor equipment during exposure, readjust technical factors or positioning based on physician's orders (Tasks 372, 373).

2. Using an understanding of diagnostic radiography and appropriate details about fluoroscopic equipment, spot filming and use of contrast media to provide technical assistance for fluoroscopic examination of patients and spot filming; being able to prepare spot film equipment for use (cassette or roll film), select cassettes, use right and left markers, position image intensifier, select exposure factors, check equipment functioning, check remote control and TV monitor, adjust focal-image intensifier distance, check focal-table distance, collimate, operate tilt table and fluoroscopic controls as ordered, load and unload cassettes in bucky (Task 464).

To accomplish these activities the student must have a detailed knowledge of the subject category, covering the appropriate technical or special terms, facts, equipment, and/or procedures which are part of this discipline and are required for successful completion of the activities listed above.

Cross Reference Footnotes: See The Following Curriculum Objectives:
Lower scale value appears in: 283 284 285 286 287 288 289.
Same scale value appears in: 290.
Lower scale value appears in: 292 293 294.